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USER'S MANUAL FOR A FULLY AUTOMATIC THREE-DIMENSIONAL POTENTIAL-FLOW CALCULATION METHOD

Part 2: With Viscous Correction by Small Crossflow Boundary-Layer Analysis

by

Dun-Pok Mack

This research was carried out under the Naval Ship Systems Command General Hydromechanics Research Program Subproject SR 023 01 01, administered by the Naval Ship Research and Development Center.

Contract N00014-74-C-0059

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II.

Part 2. With Viscous Correction by Small Crossflow Boundary-Layer Analysis.

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(10) Dun-Pok/Mack

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ABSTRACT

This report describes a computer program which calculates three-dimensional viscous effects on the lift and pressure distributions of arbitrary three-dimensional bodies. The program is a combination of a panel method, which computes the potential flow about arbitrary three-dimensional lifting configurations, and a three-dimensional boundary-layer method, which calculates the viscous effects with small crossflow. These effects are applied to the three-dimensional shape, as in Part 1, in a "strip-theory" sense and the resultant viscous lift and pressure distributions are again produced. The method of simulating the boundary layer in the final potential-flow calculation is by the addition of the displacement thickness to the original shape.

The computer program is written in Fortran IV for the IBM 370 systems. 16 temporary external units are used for storage. The region size needed to execute the program is about 360K bytes, but this is a direct function of the number of elements defining the configuration.

Also presented in this report is a detailed description of the program logic, complete instructions for executing the program, and a sample case.

TABLE OF CONTENTS

1.0 INTRODUCTION

This is the second part of the user's manual for operating the combined three-dimensional potential-flow boundary-layer computer program. This part of the report concentrates on the procedure for obtaining the displacement thickness from the boundary-layer program in a three-dimensional form which allows for small crossflows.

The operation of this program is similar to that described in Part 1 [2]. The flow field data are generated and the input body shape is separated into lower and upper regions. The flow field data are then input to the streamline program to obtain the streamline curvature, orthogonal curvature and the streamline distances between the streamline points. These quantities are saved and reorganized to the form that is acceptable to the three-dimensional boundary-layer program which is based on that of reference 4.

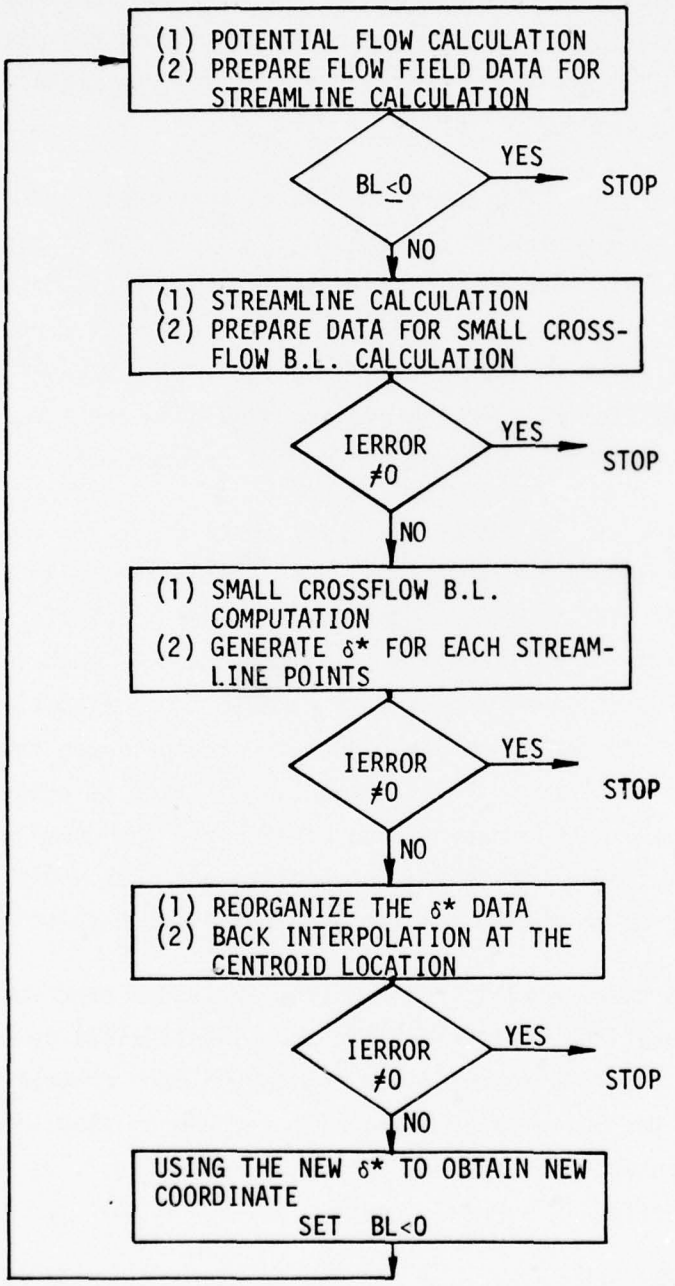
When the boundary-layer properties with small crossflows have been calculated, the displacement thicknesses, δ^*, associated with the streamline points are obtained. The lower and upper surface δ^* fields are defined at the streamline points. A surface interpolation method is used to obtain the δ^* at the control points that are used to compute the potential-flow calculation. After the interpolated δ^* procedure is accomplished, the surface displacement method of boundary-layer simulation is used as described in Part 1 of this manual. The generated coordinates are the coordinates with the boundary-layer effect. These new body points are once again input to the potential-flow program to obtain the final potential-flow solution.

At the present time, a multistep computer execution procedure is used for the above computation. This gives the user the flexibility to run the whole procedure as a single computer job, or to run each program step separately and examine the output at the end of each program step; in the latter case, data are saved and the user has the option of using it as input to the next step or to override it by card input.

All the programs should be compiled and stored before executing with data. The programs are written in Fortran IV language to be run in the IBM/370 system and a direct access unit is required in the streamline calculation.

2.0 PROGRAM NOTES

2.1 Program Logic Flow Diagram



2.2 Potential-Flow Calculation

The potential-flow calculation is performed initially to generate the flow-field data, i.e., the surface velocities, pressure coefficients, centroids and unit normals, etc. This calculation is used again after the displacement thickness has been added to the input body coordinates.

The major part of the potential-flow program is the same as described in Part 1 of this manual. There are a few additional routines here designed solely for the small crossflow version which are not needed in the version described in Part 1.

The functions of these particular routines are:

(1) Compute the u, v coordinate of each input element and their derivatives with respect to x and y.

(2) Compute the stagnation point and separate the input lifting body into two regions. Each region starts at three elements before the stagnation point and goes toward the trailing edge.

(3) Organize the flow-field data of these regions to be used in the streamline routines.

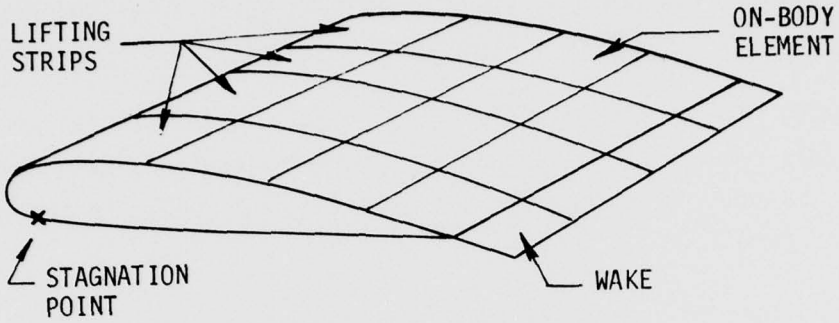
The following units are saved:

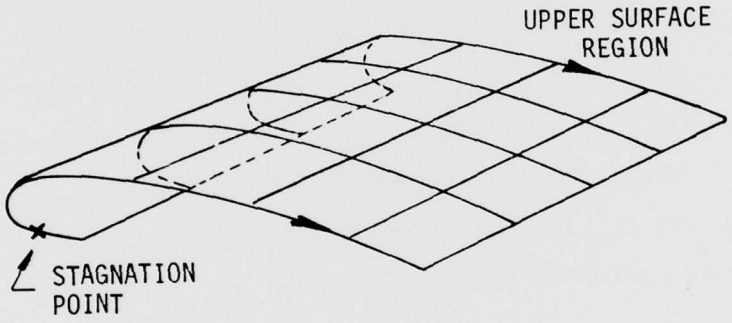
(1) Unit #2 – stores the u,v data.

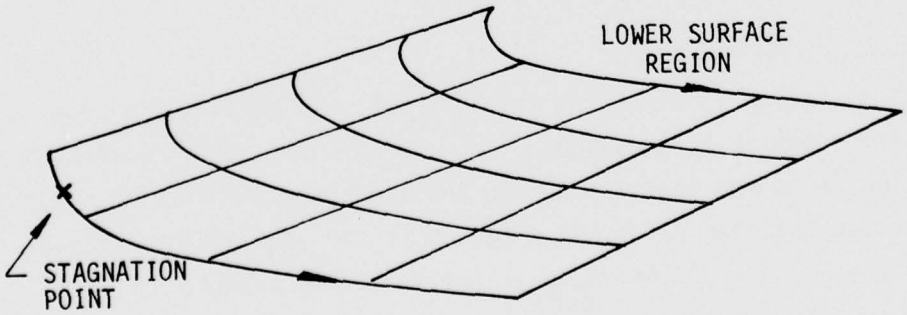
(2) Unit #21 – stores the flow-field data for each region.

2.3 Region Data Organization

A lifting section is separated into two regions; namely, the lower surface region and the upper surface region. Each region starts at a location near the stagnation point and goes toward the trailing edge. A lifting strip, therefore, is divided into two parts and a region is composed of the parts of these lifting strips. This is illustrated in the following sketch.







For each element in the region, there are 21 flow quantities associated with it, which over the whole region define the flow field that will be used for surface interpolation. The flow data and their storing sequence for each element follows.

(1) x_c
(2) y_c
(3) z_c — centroid component of the element.

(4) MU
(5) MV — equations (9) and (15) of [1].

(6) $V\xi$
(7) $V\eta$ — velocities parallel to ξ and η axes. See 9.3 of [1].

(8) V_x
(9) V_y
(10) V_z — components of surface velocity

(11) U_o
(12) V_o — nonorthogonal coordinates pertaining to the midpoint of a panel.

(13) a_{11}
(14) a_{12}
(15) a_{13}
(16) a_{21}
(17) a_{22}
(18) a_{23}
(19) a_{31}
(20) a_{32}
(21) a_{33} — components of the transformation matrix

These flow data are stored for each on-body element, strip by strip, from the starting element of the region to the trailing-edge element (excluding wakes). The lower surface is considered as region No. 1 and the upper surface is region No. 2. The program uses unit No. 21 to store the flow-field data. In addition to the flow-field data, eight quantities that are associated with the stagnation point for each strip are also stored following the flow-field data. They are:

(1) CPSTAG — pressure coefficient
(2) WESTAG — surface velocity
(3) XSTAG
(4) YSTAG
(5) ZSTAG — components of the stagnation point

(6) TSX
(7) TSY } components of the tangent vector
(8) TSZ

The aforementioned data are all to be used in the streamline routine. Specifically there are three external units to be saved:

(1) Unit #4 – geometry data of each element
(2) Unit #2 – nonorthogonal coordinates
(3) Unit #21 – flow-field data of the two regions

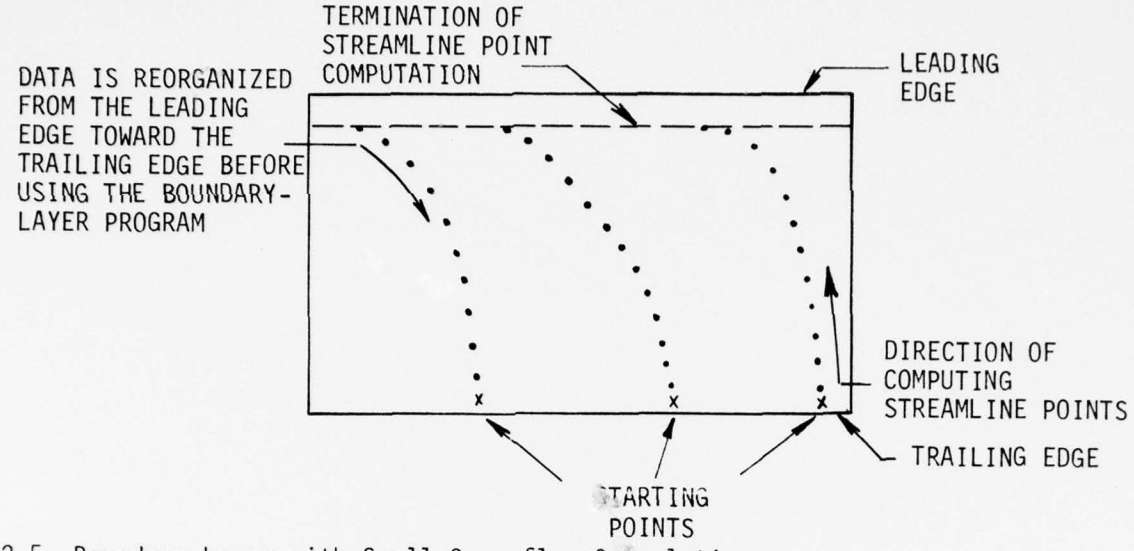
2.4 Streamline Calculation

The streamline calculation program is a modified version of the streamline calculation from the Mark IV supersonic-hypersonic arbitrary-body program [3]. A direct-access unit is used to store the flow-field data (the unit is defined as unit #10 in the program). Pointers for regions, and streamline points are saved so that users may use the same data again if the streamline program is to be run independently. The flow field data can be input by cards or passed from the potential-flow calculation program in unit #21 as stated previously.

After the flow-field data are input, an option is provided to check the flow-field data without going into the streamline calculation. If the streamline calculation is desired, the spacing between streamline points has to be input. The program will compute the streamline points from the trailing edge element toward the stagnation point using a fourth-order Runge-Kutta integration method with the user supplied spacing. Surface interpolation is performed to obtain the interpolated flow-field data at the streamline points. Orthogonal curvature is also computed at the same time.

Upon completion of all the streamline points for both regions, the program will organize the streamline data such that the order is from the stagnation point to the trailing edge. Streamline curvatures are also computed.

The following sketch illustrates the way the streamlines are calculated and organized for input to the boundary-layer calculation.



2.5 Boundary Layer with Small Crossflow Calculation

The small crossflow boundary-layer program used in this calculation is a modified version of [4]. The boundary-layer program uses the generated output from the streamline program, one streamline at a time, to compute the displacement thickness at each of the streamline points.

The input to this program requires the following data:

(1) Number of points, station (x), the arc length between these stations, their curvature and their velocities.

(2) Reynolds number per foot, reference velocity in ft/sec.

(3) The point number of the transition location on each strip.

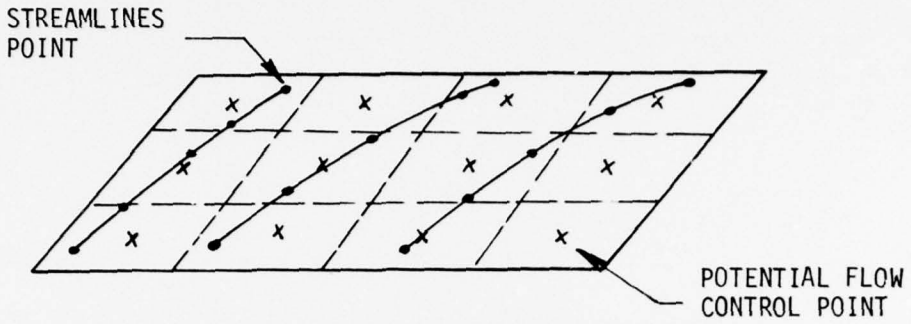
Items (1) and (2) above may be input by card as an option (see Section 3.3), as well as passed by the program. Only the transition location numbers must be input as punched cards.

On output, the displacement thicknesses (δ^*) are stored for each streamline point to be used for back interpolation.

2.6 Back Interpolation

The term back interpolation used here means that the displacement thickness values obtained from the small crossflow boundary-layer program at the streamline points, which define the δ^* over the whole region surface, are used to obtain δ^* at the original potential-flow calculation control points by using

the surface interpolation method as illustrated in the following figure.



After the δ^* at each control point is obtained, they are added to the original input coordinates in the same manner as described in Part I, [2] and in [1].

2.7 Simulation Program

This part of the program handles the generation of new coordinates with the δ^* added on as described in Part 1 [2]. Output may be saved on external units or punched on cards. They are used as input when recalling the potential-flow program.

2.8 Program Option

Listed below are the options that may be selected.

(1) All of the potential-flow calculation options (note the restrictions mentioned in the next section).

(2) Options to make a complete run in the streamline program or partial run to examine the data. Option to print every streamline point or every other point.

(3) Option to input the flow-field data by cards or by external unit, i.e., tape or disk.

(4) Print output option in the small crossflow boundary-layer program.

(5) Option to execute the individual streamline in the small crossflow boundary-layer program.

(6) Option to override the internally generated transition location.

2.9 Program Restriction

At present, this program is subject to the following restrictions:

(1) Applicable only to the lifting body.

(2) One angle of attack.

(3) One section input.

(4) The number of elements that define a region must not be greater than 500.

(5) No more than 100 points per streamline.

3.0 INPUT INSTRUCTION

3.1 Potential Flow Program Input

Card 1 – Title card (required)

Format (18A4)

cc 1-68	TITLE	Title of the case, 68 alphanumeric characters.
cc 69-72	TITLE(18)	If two points (2 sets of x,y,z) per card input, leave blank. If 1 point (1 set of x,y,z) per card input, punch "bØNE", where b means blank.

Card 2 – Control parameter card (required)

Format (A4, 13I3, 3F4.0, F12.0)

cc 1-4	CASE	Case identification
cc 5-7	LIFSEC	Total number of lifting sections
cc 8-10	MØMENT	Moment origin input flag
cc 11-13	KUTTA	Kutta point input flag
cc 14-16	NØFF	Off-body point input flag
cc 17-19	LIST	Partial execution flag
cc 20-22	MPR	Matrix print flag
cc 23-25	IØUT	Geometry quantities print flag
cc 26-28	IG	Ignored element flag
cc 29-31	LASWAK	Special last wake calculation flag
cc 32-34	IATACK	Number of angles of attack
cc 35-37	IWIDTH	Piecewise vorticity option flag
cc 38-40	ISAVE	Stepwise pressure Kutta option
cc 41-43	IPCV	Parabolic vorticity option flag
cc 44-47	SYM1	Flag for one plane symmetry
cc 48-51	SYM2	Flag for two planes of symmetry
cc 52-55	BL	Flag for boundary-layer calculation

cc 56-58	IN	Unit number that contains the input data.

Note: For the calculation that this part of the report describes, the variables of this card should have the following values:

LIFSEC = 1

IATACK = 1

BL = 1 for initial potential-flow calculation.

BL = 0 for final potential-flow calculation after the new coordinates are generated.

Card 3 — Angle of attack card (required)

Format (6E10.0)

cc 1-10	ALPHAX(1)	The x-component of the first input angle of attack.
cc 11-20	ALPHAY(1)	The y-component of the first input angle of attack.
cc 21-30	ALPHAZ(1)	The z-component of the first input angle of attack.
cc 31-40	ALPHAX	The x,y,z components of the second input angle of attack, if any. If there is no second input angle of attack, leave these fields blank.
cc 41-50	ALPHAY	
cc 51-60	ALPHAZ	

Note: Repeat this card until total input angle of attack = IATACK with two angles of attack on each card.

Card 4 — Moment origin card (optional)

Format (6E10.0)

cc 1-10	ØRIGNX	The x,y,z components of the input moment origin.
cc 11-20	ØRIGNY	
cc 21-30	ØRIGNZ	

Note: This card is used if MØMEN≠0 on card 2.

Card 5 — Lifting section information card (required)

Format (16I4)

cc 1-4	NSØRCE(1)	Number of on-body elements on each strip in the first lifting section.
cc 5-8	NWAKE(1)	Number of wake elementson each strip in the first lifting section.

cc 9-12 NSTRIP(1) Number of strips in the first lifting section.

cc 13-16 IXFLAG(1) Extra strip flag in the first lifting section.

Note: The same format is repeated from cc 17-cc 64. Four lifting sections information can be put on 1 card and may repeat the same format on the next card if there are more than four sections. Users are advised to use only 1 lifting section if streamline calculation is used.

Card 6 – Ignored Element Card (optional)

Format (16I4)

cc 1-4 IG1(1,1) First element number on the first strip of the first lifting section to be ignored.

cc 5-8 IGN(1,1) Last element number on the first strip of the first lifting section to be ignored.

Note: This card is needed only if IG≠0 on card 2. Repeat the same format for the other strips of the same section. Start a new card for another section.

Card 7 – Strip widths card (required)

Format (6E10.0)

cc 1-10 WIDXTR Width of the first extra strip of the first section, if any. If no extra strip input, leave blank.

cc 11-20 WIDTH(1,1) Width of the first strip of the first lifting section.

cc 21-30 WIDTH(2,1) Width of the second strip of the first lifting section.

cc 31-40 WIDTH(3,1) Width of the third strip of the first lifting section.

Note: Repeat the same format with 6 strip widths per card. After the last strip width, it should follow by the strip width of the last extra strip of the section whether there is extra strip input or not. 0.0 is used if there is no input last extra strip.

Card 8 – Body definition card (required)

Format (2(3E10.0,2I1) – For 2 input points per card

Format (3E10.0, 2I1) – For 1 input point per card

cc 1-10	X	x,y,z components of the input point.
cc 11-20	Y	
cc 21-30	Z	
cc 31	STATUS	Status flag 0 = same n-line 1 = new n-line 2 = new section 3 = end input
cc 32	LABEL	Element type 0 = nonlifting 1 = lifting

Note: Repeat the same group from cc 33 - cc 64 for the next input point, if two points per card format were used.

Card 9 — Kutta control point card (optional)

Format (6E10.0)

cc 1-10	CUTTAX(I)	x,y,z components of the first input Kutta control points.
cc 11-20	CUTTAY(I)	
cc 21-30	CUTTAZ(I)	
cc 31-40	CUTTAX(I+1)	x,y,z components of the next input Kutta control points.
cc 41-50	CUTTAY(I+1)	
cc 51-60	CUTTAZ(I+1)	

Note: This card is used only when KUTTA≠0 on card 2.

Card 10 — Kutta normal card (optional)

Format (6E10.0)

cc 1-10	CNX(I)	x,y,z components of the input Kutta control point normal vector.
cc 11-20	CNY(I)	
cc 21-30	CNZ(I)	
cc 31-40	CNX(I+1)	x,y,z components of the next input Kutta control point normal vector.
cc 41-50	CNY(I+1)	
cc 51-60	CNZ(I+1)	

Note: This card is needed only if KUTTA≠0 on card 2.

Card 11 — Off-body point card (optional)

Format (2(3E10.0,I1)

cc 1-10	XØFF(I)	x,y,z components of the input off-body points.
cc 11-20	YØFF(I)	
cc 21-30	ZØFF(I)	
cc 31	LABEL	Status flag

cc 32-41	XØFF(I+1)	x,y,z components of the next off-body point.
cc 42-51	YØFF(I+1)	
cc 52-61	ZØFF(I+1)	
cc 62	LABL	Status flag

Note: LABL=3 at the end of the off-body point input, otherwise leave it blank. This card is needed only when NØFF≠0.

2.2 [illegible]ne Program Input

Card 1 – [illegible]itle and option card (required)

Format (18A4,I2)

cc 1-72	TITLE	Any appropriate title for the case to be run.
cc 73-74	IØPT	Option flag IØPT=0 No option used. IØPT=1 No streamline calculation but uses the previous streamline results to prepare for the small crossflow boundary-layer calculation. IØPT=2 Streamline calculation only.

Note: When the flow-field data of the case is loaded first time onto the direct-access unit, set TITLE(18)="bbb1" this enables the program to print the data for user to check.

Card 2 – Master directory title card (required)

Format (1I1,19X,10A4)

cc 1	MFLAG	MFLAG=0 to initialize the master directory, i.e., anytime user wishes to override the direct-access data or defines a new data file. MFLAG≠0 Implies the data set has been previously stored.
cc 21-60	TITLEM	Any description for the master directory.

Card 3 – Set directory title card (required)

Format (2I1,1X,I1,F6.0,10X,10A4)

cc 1	LASTS	This flag should be set = 1.
cc 2	NEWS	NEWS=0 New data set input. NEWS≠0 Data set already stored.
cc 4	NSET	Data set number. This should be set = 1
cc 5-10	MACH	Mach number
cc 21-60	TITLES	Any description of the set title.

Card 4 — Region set control card (required)

Format	(2I1,I2,2F6.0,4X,10A4)		
cc 1	LASTAB	LASTAB=0 Indicates more than one region. LASTAB≠0 Means this is the last region.	
cc 2	NEWAB	NEWAB=0 For new region. NEWAB≠0 For subsequent regions.	
cc 3-4	IAB	Region number	
cc 5-10	ALPHA	α value	These values should be set =0 when input.
cc 11-16	BETA	β value	
cc 21-60	TITLEA	Region title	

Note: Lower surface of the wing is considered as Region #1, and upper surface is considered as Region #2 in this program.

Card 5 — Subregion set control card (required)

Format	(2I1,I2,3I1,13X,10A4)	
cc 1	LASTR	LASTR=0 Indicates more than 1 subregion within the region. LASTR≠0 Implies this is the last subregion.
cc 2	NEWR	NEWR=0 For new subregion. NEWR≠0 For subsequent subregions within the region data set.
cc 3-4	IREG	Subregion set number.
cc 5	IDTYP(1)	This field is always set equal to 2 .
cc 6	ISØRCE	This field is not used at present and is set to 0.
cc 7	IRW	Data read or write flag IRW=0 Data will be input and saved on direct-access unit 10. IRW=1 Data has been saved and will be read in from direct-access unit 10.
cc 21-60	TITLER	Subregion title

Note: Cards numbered 4, 5 used as a group for the lower surface of a wing. The same group of cards is used for the upper surface before the next card is input.

Card 6 – Streamline input card #1 (required)

Format (I1,3I2,3I1,10I2,5I1,3F10.7)

cc 1	LASTR	Last flow region flag LASTR=0 This is not the last streamline set of data. After all the streamlines for this region are calculated, subroutine STREAM will read another region data from unit 10 and input. LASTR=1 This is the last region. After the streamline for this region is completed, no further region data will be read.
cc 2-3	NDSET	Data set number where surface flow data will be found on #10. Note: This flag should be the same as NSET on card 3.
cc 4-5	IABSET	Region set number. This number should be agreeable to IAB in card 4.
cc 6-7	IR	Subregion number. This number should be the same as IREG on card 5.
cc 8	INØRM	This field is set equal to 0.
cc 9	ISURF	This field is set equal to 0.
cc 10	IPF	This field is set equal to 0.
cc 11-30	ISR(1) to ISR(10)	Subregion flow number. Since this version of the program does not use subregion, ISR(1)=1, and the rest of the array is set equal to 0.
cc 31-35	ISF(1) to ISF(5)	Secondary flow number. The whole array is set equal to 0.
cc 36-45	DELTA1	A criteria used with EPS1 to ensure that the streamline point has reached the stagnation line. Suggested value = 0.999.
cc 46-55	EPS1	Suggested value for this criteria is 0.01.
cc 56-65	EPS2	A criteria for terminating the streamline calculation, if the difference between two successive coordinates is less than EPS2. Suggested value 0.001.

Card 7 – Streamline input card #2 (required)

Format (2I2,16X,10A4)

cc 1-2	IRSAVE	Streamline save flag IRSAVE=0 Do not save. IRSAVE≠0 Streamline data will be saved on unit 10.
cc 3-4	NSTR	Number of streamlines to be calculated for the input region number.
cc 21-60	TITLER	Title for streamline flow region.

Card 8 – Streamline input card #3 (required)

Format (2I2,3I1,I2,I4,7X,4F10.0)

cc 1-2	IPRINT	Streamline print flag. IPRINT=0 No streamline data will be printed. IPRINT=2 Print streamline data for every second DELTAS point. IPRINT=3 Print streamline data for every third DELTAS point. etc.
cc 3-4	ISAVE	Streamline save flag. ISAVE=0 No streamline data will be used. ISAVE=2 Save streamline data for every second DELTAS point. ISAVE=3 Save streamline data for every third point. etc.
cc 5	ISTART	Streamline starting condition flag. ISTART=1 Starting point of streamline. Calculation is obtained from unit #10. ISTART≠1 User will input the starting point of the streamline calculation.
cc 6 cc 7 cc 8-9 cc 10-13	ISTAG ISMØDE IPANL L	These fields should be left blank at present.
cc 21-30	DELTAS	Streamline integration distance step interval for the Runge-Kutta integration process. (May be negative to integrate forward.)
cc 31-40 cc 41-50 cc 51-60	XSI YSI ZSI	x,y,z components of the streamline starting point. Input these fields only if ISTART≠1.

Repeat card no. 9 as many times as the number of streamline NSTR input in card no. 8.

Note: Cards nos. 7, 8, 9 are input as a group for one region (say, lower surface of the wing). If LASTR=0 is input in card no. 7, then the same cards (i.e., 7, 8, 9) should be used again for additional region.

Card 9 — Reference velocity and Reynolds number card (required)

Format (3F15.6)

cc 1	VREF	Reference velocity in ft/sec to be used in boundary-layer program.
cc 16	REREF	Reynolds number in unit of ft^{-1}.
cc 31	SF	Input scale factor to convert the basic points in the unit of ft. For example, if the original input to the potential-flow program is in inches, then the SF here should be input as 12 so the program can convert the points to feet. SF is input as 1.0 if original input is already in feet.

3.3 Small Crossflow Boundary-Layer Program Input

Card 1 — Option card (required)

Format (6I5)

cc 1-5	NCASE	Total number of cases input. Example: If there are six streamlines in one region (say, lower surface), then NCASE=6, etc.
cc 6-10	INTAPE	Unit number that contains the input data.
cc 11-15	IØUTAP	Unit number that will contain the output.
cc 16-20	IØPT	Print option flag. IØPT=0 Short print IØPT=1 Selected output print IØPT=2 Long print
cc 21-25	JØPT	Selects input region number and streamline number to be executed. This option is designed for users who wish to execute only the selected streamlines in the boundary-layer program and skip the rest of the streamlines. JØPT=0 Execute every streamline. JØPT≠0 Input the region number and streamline number. Notice that if only 3 streamlines were selected, then NCASE=3 is in cc 5.

cc 26-30	NØPT	NØPT=0	Program will use the input transition location.
		NØPT≠0	Program will check the input transition location. If the input transition location is beyond the acceptable range, the program will override it with a location that coincides with the change of velocity profile.

Card 2 – Region and streamline number input card (optional)

Format (20A4)

cc 1-4	SET(1)	Region number in which the streamline will be used.
cc 5-8	SLINE(1)	Streamline number to be executed in the boundary-layer program.

Repeat the same format for the next selected streamline to be executed. The streamline numbers may be entered on one card. This card is not needed if JØPT=0 is entered on card 1.

Card 3 – Region title card (optional)

Format (16A4)

cc 1-40	TITLE(1) to TITLE(10)	Any suitable header.
cc 41-44	TITLE(11)	This field should contain region number.
cc 60-64	TITLE(16)	This field should contain streamline number.

Note: If the data come from a prestored unit, i.e. INTAPE≠5, this card is not required.

Card 4 – Control flag card (optional)

Format (5I1,3I3,3E14.6)

cc 1	FL1	This flag is set equal to 1.
cc 2	FL2	This flag is set equal to 2.
cc 3	FL3	These flags are set equal to 0.
cc 4	FL4	
cc 5	FL5	
cc 6-8	NXT	Total number of points.
cc 9-11	NTR	Transition location.

cc 12-14	NNN	(Not used)
cc 15-28	VGP	VGP=1.14
cc 29-42	DETA1	DETA1=0.01
cc 43-56	EPS	EPS=0.001

Note: This card is needed only if INTAPE=5.

Card 5 – Velocity and Reynolds number card (optional)

Format (4E14.6)

cc 1-14	VREF	Reference velocity in ft/sec.
cc 15-28	REREF	Reynolds number in ft^{-1}.
cc 29-42	SWANG	This field is input with 0.0
cc 43-56	P30	P30=1.0 for user input .

Note: This card is required only if INTAPE=5.

Card 6 – Station data card (optional)

Format (4E14.6)

cc 1-14	X(I)	Streamline distance between point I and the starting point.
cc 15-28	UE(I)	Surface velocity at Ith station.
cc 29-42	RK1(I)	Orthogonal curvature at Ith station.
cc 43-56	RK2(I)	Streamline curvature at Ith station.

Note: One station data per card. Repeat the same format for another station. This card is needed only if INTAPE=5.

Card 7 – Transition location card (required)

Format (I5)

cc 1-5	NTR	Streamline point number designated as the user input transition location. Note that point No. 1 is the stagnation point.

4 Back Interpolation Program Input

Card 1 – Data set title card (required)

Format (16A4,I4)

cc 1-64	TITLE	Header of the region to be executed.

cc 65-68	ISET	ISET=1 For one region. ISET=2 For two regions.

Card 2 – External unit definition card (required)

Format (14I5)

cc 1-5	IØUTAP	Unit number from boundary-layer program which stores the δ^* values.
cc 6-10	IUNITB	Scratch units to be used in the matrix solution subroutines.
cc 11-15	IUNITC	
cc 16-20	IUNITD	
cc 21-25	IFT20	Unit number from the potential-flow program which stores the U_0, V_0 values. This unit number is defined as no. 20. User may change it in the potential-flow program if so desired.
cc 26-30	IFT22	Unit number that stores the interpolated δ^* at the potential-flow calculation control points. This is the output unit from this program and it will be used in the final potential-flow computation.
cc 31-35	KSØRCE	Number of source elements per lifting strip as input to the potential-flow program.
cc 36-40	KWAKE	Number of wake elements per lifting strip as input to the potential-flow program.
cc 41-45	IEXTRA	Number of extra strips as input to the potential flow program.

Card 3 – Streamline information card (optional)

Format (14I5)

cc 1-5	ISTRM(I)	Streamline region number.
cc 6-10	NSLINE(I)	Number of streamlines within the region.
cc 11-15	LSTART(I)	Starting address of the first streamline within the region.
cc 16-20	ILIM1(I)	Starting element number of the strip from potential-flow program that is used as the lower limit of the region.
cc 21-25	ILIM2(I)	Ending element number of the strip from the potential-flow program that is used as the upper limit of the region.

Note: This card is needed only if user wants to run this program as a separate run. Otherwise data will be stored and passed into this program.

Card 4 – u,v data card (optional)

Format (6F12.6)

cc 1-12	UTE(I)	u-coordinate of the u-v plane at the trailing edge. This is calculated in the potential-flow program.
cc 13-24	ULE(I)	u-coordinate at the leading edge. Obtained from potential-flow program.
cc 25-36	VTE(I)	v-coordinate of the u-v plane at the trailing edge. This is calculated in the potential-flow program.
cc 37-48	VLE(I)	v-coordinate at the leading edge.
cc 49-60	CRØØT(I)	Distance of the root chord in the u-v plane between the trailing edge and the leading edge. This is obtained from streamline program.
cc 61-72	CTIP(I)	Distance of the tip chord in the u-v plane between the trailing edge and the leading edge. This also is obtained from streamline program.

Note: All the above data is for region I. This card is needed only if the program is run separately.

Card 5 – Streamline output condition card (optional)

Format (14I5)

cc 1-5	NSPT(I,IS)	Number of streamline points of the Ith streamline in the ISth region.
cc 6-10	ICØND(I,IS)	ICØND=0 Means the streamline computation ends normally and the points can be used. ICØND=1 Indicates the streamline computation does not end normally and this streamline should be skipped. I For streamline count. IS For region number.
cc 11-15	LPØINT(I,IS)	Starting address in the direct-access unit #10 to be used for retrieving the streamline data.

Note: One streamline information per card. Repeat the same format for another streamline. This card is needed only if the program is run independently.

3.5 Final Potential-Flow Program Computation

This part of input is the same as the initial potential-flow program (see 3.1) with the following exceptions:

1. BL on card 2 is input with a negative value, say -1.0.
2. Body points input is not needed.

The remaining input is the same as the initial potential-flow calculation input.

4.0 DECK SETUP

Two types of JCL deck setups are given for a multistep job. The first type shows the JCL setup for computing, linkediting and executing each step of the program. The second JCL setup is for the case where all the steps of the program have been stored on a diskpack prior to execution.

Although these examples are for a multistep job, each program may be run individually. In this case, the data sets to be saved in each step should be kept rather than passed into the next program step. For example, in the potential-flow program, initial calculations, there is a DD-card for Unit 21 defined as follows:

```
//GO.FT21F001  DD  DSN=RUNCASE.FLØWDATA,UNIT=TAPE16,
//               DISP=(NEW,PASS),
//               DCP=(RECFM=VBS,BLKSIZE=6447,BUFNØ=1),
//               LABEL=(1,SL,RETPD=180)
```

The disposition parameter indicates that this data set is to be passed into the next step, i.e., the streamline calculation program. However, if it is desired to save this data set and use it at a later time, this can be accomplished by changing the disposition parameter to:

```
DISP=(NEW,KEEP),
```

in the aforementioned DD-card.

It is also possible to allow a certain data set to be punched on cards rather than saved on tape or disk. In that case, the punch cards may be input to the next program after the output of the previous program has been examined. This capability is applicable to those data sets that have the record format RECFM=FB defined in the DD statement.

In short, if these program steps are to be run independently, it is necessary to change some JCL parameters. Users may have to alter the JCL decks according to the system they are using.

4.1 JCL Setup for Compiling the Source Program, Linkediting the Compiled Module and Running Data

(a) Potential Flow Program, Initial Calculation

Card Columns

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

```
//STEP1   EXEC  FORTXCLG,PARM.FORT='XREF,OPT=2',
//              PARM.LKED='MAP,LIST,OVLY',REGION.GO=380K
//FORT.SYSUT2   DD  DSN=&SYSUT2,UNIT=SYSDA,SPACE=(TRK,(5,5))
//FORT.SYSIN DD *
    ( REPLACE THIS CARD WITH POTENTIAL FLOW PROGRAM DECKS. )
/*
//LKED.SYSIN DD *
     ENTRY MAIN
     OVERLAY ALPHA
       INSERT BDFORM
       INSERT POINTS
       INSERT MISC
       INSERT NOLIFT
       INSERT LIFT
     OVERLAY BETA
       INSERT INPUT
     OVERLAY BETA
       INSERT DINPUT
     OVERLAY ALPHA
       INSERT UVGEN
     OVERLAY ALPHA
       INSERT VFORM
       INSERT MOMENT
       INSERT FIELDS
     OVERLAY BETA
       INSERT VFMNLF
     OVERLAY BETA
       INSERT VFMLFT
     OVERLAY ALPHA
       INSERT PSWISE
     OVERLAY ALPHA
       INSERT AFORM
     OVERLAY ALPHA
       INSERT MATSOL
       INSERT SPACER
     OVERLAY BETA
       INSERT COLSOL
     OVERLAY BETA
       INSERT SOLMOR
     OVERLAY ALPHA
       INSERT COMFLO
       INSERT MIS1
       INSERT FINAL
     OVERLAY BETA
       INSERT PKUTTA
     OVERLAY BETA
       INSERT PRINT
     OVERLAY ALPHA
       INSERT GETRDY
     OVERLAY ALPHA
       INSERT MODXYZ
```

(continued)

Card Columns

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
```

```
//GO.FT01F001 DD DSNAME=&FT01,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT02F001  DD  DSN=RUNCASE.UVDATA,UNIT=TAPE16,DISP=(NEW,PASS),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
//              LABEL=(1,SL,RETPD=180)
//GO.FT03F001 DD DSNAME=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT04F001  DD  DSN=RUNCASE.GEOMDATA,UNIT=TAPE16,DISP=(NEW,PASS),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
//              LABEL=(1,SL,RETPD=180)
//GO.FT07F001 DD SYSOUT=B
//GO.FT08F001 DD DSNAME=&FT08,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT09F001 DD DSNAME=&FT09,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT10F001 DD DSNAME=&FT10,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT11F001 DD DSNAME=&FT11,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT12F001 DD DSNAME=&FT12,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT13F001 DD DSNAME=&FT13,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT14F001 DD DSNAME=&FT14,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT15F001 DD DSNAME=&FT15,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT16F001 DD DSNAME=&FT16,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT17F001 DD DSNAME=&FT17,UNIT=SYSDA,SPACE=(TRK,(10,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT18F001 DD DSNAME=&FT18,UNIT=SYSDA,SPACE=(TRK,(10,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT19F001 DD DSNAME=&FT19,UNIT=SYSDA,SPACE=(TRK,(10,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT21F001  DD  DSN=RUNCASE.FLOWDATA,UNIT=TAPE16,DISP=(NEW,PASS),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
//              LABEL=(1,SL,RETPD=180)
//GO.FT23F001  DD  DSN=&FT23,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT24F001  DD  DSN=&FT24,UNIT=SYSDA,SPACE=(TRK,(50,5)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.SYSIN DD *
    ( REPLACE THIS CARD WITH THE INPUT DATA TO POTENTIAL FLOW PROG. )
/*
```

(b) The Streamline Calculation Program

Card Columns

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

```
//STEP2  EXEC  FORTXCLG,PARM.FORT='OPT=2,XREF',REGION.GO=250K
//FORT.SYSUT2  DD  DSN=&SYSUT2,UNIT=SYSDA,SPACE=(TRK,(5,5))
//FORT.SYSIN DD *
    ( REPLACE THIS CARD WITH THE STREAMLINE CALCULATION PROGRAM DECKS.)
/*
//GO.FT01F001  DD  DSN=OUTDATA.TL4EY,UNIT=TAPE16,DISP=(NEW,PASS),
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=4000),
//             LABEL=(1,SL,RETPD=180)
//GO.FT02F001  DD  DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//             DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT03F001  DD  DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//             DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT04F001  DD  DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//             DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT07F001  DD  SYSOUT=B
//GO.FT10F001  DD  DSN=DAC.F0H3.DPM.J1HB.RUNCASE,UNIT=3330-1,
//             DCB=(DSORG=DA,BUFNO=1),VOL=SER=CSLB30,DISP=(NEW,PASS)
//             SPACE=(100,(2000))
//GO.FT15F001  DD  DSN=*.STEP1.GO.FT02F001,DISP=(OLD,PASS)
//GO.FT16F001  DD  DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
//GO.FT21F001  DD  DSN=*.STEP1.GO.FT21F001,DISP=(OLD,KEEP)
//GO.SYSIN  DD *
    ( REPLACE THIS CARD WITH THE INPUT DATA TO THE STREAMLINE PROG. )
/*
```

(c) The Small Crossflow Boundary-Layer Program

Card Columns

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

```
//STEP3   EXEC  FORTXCLG,PARM.FORT='XREF,OPT=2',REGION.GO=200K
//FORT.SYSUT2   DD  DSN=&SYSUT2,UNIT=SYSDA,SPACE=(TRK,(5,5))
//FORT.SYSIN DD *
    ( REPLACE THIS CARD WITH THE BOUNDARY LAYER PROGRAM DECK. )
/*
//GO.FT01F001   DD  DSN=*.STEP2.GO.FT01F001,DISP=(OLD,KEEP)
//GO.FT02F001   DD  DSN=DSTAR.FL4FY,UNIT=TAPE16,DISP=(NEW,PASS),
//              DCB=(RECFM=FB,LRECL=80,BLKSIZE=4000),
//              LABEL=(1,SL,RETPD=180)
//GO.FT03F001   DD  DSN=*.STEP1.GO.FT02F001,DISP=(OLD,PASS)
//GO.FT04F001   DD  DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
//GO.FT10F001   DD  DSN=*.STEP2.GO.FT10F001,DISP=(OLD,PASS)
//GO.FT07F001   DD  SYSOUT=B
//GO.SYSIN   DD *
    ( REPLACE THIS CARD WITH THE INPUT DATA TO THE BOUNDARY LAYER PROG)
/*
```

(d) The Back Interpolation Program

```
//STEP4   EXEC  FORTXCLG,PARM.FORT='XREF,OPT=2',REGION.GO=220K
//FORT.SYSUT2   DD  DSN=&SYSUT2,UNIT=SYSDA,SPACE=(TRK,(5,5))
//FORT.SYSIN DD *
    ( REPLACE THIS CARD WITH THE BACK INTERPOLATION PROGRAM DECKS. )
/*
//GO.FT01F001   DD  DSN=*.STEP3.GO.FT02F001,DISP=(OLD,KEEP)
//GO.FT02F001   DD  DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT03F001   DD  DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT04F001   DD  DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT07F001   DD  SYSOUT=B
//GO.FT10F001   DD  DSN=DAC.EQH3.DPM.J1HB.RUNCASE,UNIT=3330-1,
//              DCB=(DSORG=DA,BUFNO=1),VOL=SER=CSLB30,DISP=(OLD,KEEP),
//              SPACE=(100,(2000))
//GO.FT16F001   DD  DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
//GO.FT20F001   DD  DSN=*.STEP1.GO.FT02F001,DISP=(OLD,KEEP)
//GO.FT22F001   DD  DSN=DSTAR.TJ1HB,UNIT=TAPE16,DISP=(NEW,PASS),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
//              LABEL=(1,SL,RETPD=180)
//GO.SYSIN   DD *
    ( REPLACE THIS CARD WITH THE INPUT DATA TO THE BACK INTERP. PROG. )
/*
```

(e) The Final Calculation Using the Potential Flow Program.

Note that the potential-flow program is assumed to be stored on a volume identified as "CSLB30" with the data set name "DAC.EOH3.DPM.J1HB.V3".

```
0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
//STEP5  EXEC  FORTCG,REGION=380K
//STEPLIB  DD  DSN=DAC.EOH3.DPM.J1HB.V3,DISP=(SHR,PASS),UNIT=3330-1,
//            VOL=SER=CSLB30
//GO.SYSIN DD  *
//GO.FT01F001  DD  DSN=&FT01,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT02F001  DD  DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT03F001  DD  DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT04F001  DD  DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT07F001  DD  SYSOUT=B
//GO.FT08F001  DD  DSN=&FT08,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT09F001  DD  DSN=&FT09,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT10F001  DD  DSN=&FT10,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT11F001  DD  DSN=&FT11,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT12F001  DD  DSN=&FT12,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT13F001  DD  DSN=&FT13,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT14F001  DD  DSN=&FT14,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT15F001  DD  DSN=&FT15,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT16F001  DD  DSN=&FT16,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT17F001  DD  DSN=&FT17,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT18F001  DD  DSN=&FT18,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT19F001  DD  DSN=&FT19,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT21F001  DD  DSN=&FT21,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//            DCB=*.FT01F001
//GO.FT23F001  DD  DSN=*.STEP4.GO.FT22F001,DISP=(OLD,KEEP)
//GO.FT24F001  DD  DSN=*.STEP1.GO.FT04F001,DISP=(OLD,KEEP)
    ( REPLACE THIS CARD WITH THE INPUT DATA TO THE FINAL P.FLOW PROG. )
/*
//
```

4.2 JCL Setup for Executing the Programs Already Stored on an External Unit.

All program steps are stored in the volume "CSLB30."

(a) The Potential-Flow Program Step has the data set name "DAC.EOH3.DPM.J1HB.V3."

```
 Card
Column
 0         1         2         3         4         5         6         7
 12345678901234567890123456789012345678901234567890123456789012345678901234567890123
 //STEP1   EXEC   FORTGO,REGION=380K
 //STEPLIB  DD    DSN=DAC.EOH3.DPM.J1HB.V3,DISP=(SHR,PASS),UNIT=3330-1,
 //              VOL=SER=CSLB30
 //GO.FT01F001 DD DSNAME=&FT01,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT02F001   DD  DSN=RUNCASE.UVDATA,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
 //              LABEL=(1,SL,RETPD=180)
 //GO.FT03F001 DD DSNAME=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT04F001   DD  DSN=RUNCASE.GEOMDATA,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
 //              LABEL=(1,SL,RETPD=180)
 //GO.FT07F001 DD SYSOUT=B
 //GO.FT08F001 DD DSNAME=&FT08,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT09F001 DD DSNAME=&FT09,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT10F001 DD DSNAME=&FT10,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT11F001 DD DSNAME=&FT11,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT12F001 DD DSNAME=&FT12,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT13F001 DD DSNAME=&FT13,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT14F001 DD DSNAME=&FT14,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT15F001 DD DSNAME=&FT15,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT16F001 DD DSNAME=&FT16,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT17F001 DD DSNAME=&FT17,UNIT=SYSDA,SPACE=(TRK,(10,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT18F001 DD DSNAME=&FT18,UNIT=SYSDA,SPACE=(TRK,(10,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT19F001 DD DSNAME=&FT19,UNIT=SYSDA,SPACE=(TRK,(10,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT21F001   DD  DSN=RUNCASE.FLOWDATA,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
 //              LABEL=(1,SL,RETPD=180)
 //GO.FT23F001   DD  DSN=&FT23,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT24F001   DD  DSN=&FT24,UNIT=SYSDA,SPACE=(TRK,(50,5)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.SYSIN DD *
     ( REPLACE THIS CARD WITH THE INPUT DATA TO POTENTIAL FLOW PROG. )
 /*
```

(b) The streamline Calculation Program has the data set name "DAC.EOH3.DPM.J1HB.STREAM."

```
 Card
Column
 0        1         2         3         4         5         6         7
 12345678901234567890123456789012345678901234567890123456789012345678901234567890123
 //STEP2   EXEC   FORTGO,REGION=250K
 //STEPLIB  DD   DSN=DAC.EOH3.DPM.J1HB.STREAM,DISP=(SHR,PASS),
 //              UNIT=3330-1,VOL=SER=CSLB30
 //GO.FT01F001   DD   DSN=OUTDATA.TL4EY,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=FB,LRECL=80,BLKSIZE=4000),
 //              LABEL=(1,SL,RETPD=180)
 //GO.FT02F001   DD   DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT03F001   DD   DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT04F001   DD   DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT07F001   DD   SYSOUT=B
 //GO.FT10F001   DD   DSN=DAC.EOH3.DPM.J1HB.RUNCASE,UNIT=3330-1,
 //              DCB=(DSORG=DA,BUFNO=1),VOL=SER=CSLB30,DISP=(NEW,PASS)
 //              SPACE=(100,(2000))
 //GO.FT15F001   DD   DSN=*.STEP1.GO.FT02F001,DISP=(OLD,PASS)
 //GO.FT16F001   DD   DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
 //GO.FT21F001   DD   DSN=*.STEP1.GO.FT21F001,DISP=(OLD,KEEP)
 //GO.SYSIN   DD *
     ( REPLACE THIS CARD WITH THE INPUT DATA TO THE STREAMLINE PROG. )
 /*
```

(c) The Boundary-Layer Program has the data set name "DAC.EOH3.DPM.J1HB.L4EY."

```
 0        1         2         3         4         5         6         7
 12345678901234567890123456789012345678901234567890123456789012345678901234567890123
 //STEP3   EXEC   FORTGO,REGION=200K
 //STEPLIB  DD   DSN=DAC.EOH3.DPM.J1HB.L4EY,DISP=(SHR,PASS),
 //              UNIT=3330-1,VOL=SER=CSLB30
 //GO.FT01F001   DD   DSN=*.STEP2.GO.FT01F001,DISP=(OLD,KEEP)
 //GO.FT02F001   DD   DSN=DSTAR.FL4EY,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=FB,LRECL=80,BLKSIZE=4000),
 //              LABEL=(1,SL,RETPD=180)
 //GO.FT03F001   DD   DSN=*.STEP1.GO.FT02F001,DISP=(OLD,PASS)
 //GO.FT04F001   DD   DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
 //GO.FT10F001   DD   DSN=*.STEP2.GO.FT10F001,DISP=(OLD,PASS)
 //GO.FT07F001   DD   SYSOUT=B
 //GO.SYSIN   DD *
     ( REPLACE THIS CARD WITH THE INPUT DATA TO THE BOUNDARY LAYER PROG)
 /*
```

(d) The Back Interpolation Program has the data set name "DAC.EOH3.DPM.J1HB.BACKINP."

```
 //STEP4   EXEC   FORTGO,REGION=220K
 //STEPLIB  DD   DSN=DAC.EOH3.DPM.J1HB.BACKINT,DISP=(SHR,PASS),
 //              UNIT=3330-1,VOL=SER=CSLB30
 //GO.FT01F001   DD   DSN=*.STEP3.GO.FT02F001,DISP=(OLD,KEEP)
 //GO.FT02F001   DD   DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT03F001   DD   DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT04F001   DD   DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
 //GO.FT07F001   DD   SYSOUT=B
 //GO.FT10F001   DD   DSN=DAC.EOH3.DPM.J1HB.RUNCASE,UNIT=3330-1,
 //              DCB=(DSORG=DA,BUFNO=1),VOL=SER=CSLB30,DISP=(OLD,KEEP),
 //              SPACE=(100,(2000))
 //GO.FT16F001   DD   DSN=*.STEP1.GO.FT04F001,DISP=(OLD,PASS)
 //GO.FT20F001   DD   DSN=*.STEP1.GO.FT02F001,DISP=(OLD,KEEP)
 //GO.FT22F001   DD   DSN=DSTAR.TJ1HB,UNIT=TAPE16,DISP=(NEW,PASS),
 //              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1),
 //              LABEL=(1,SL,RETPD=180)
 //GO.SYSIN   DD *
     ( REPLACE THIS CARD WITH THE INPUT DATA TO THE BACK INTERP. PROG. )
 /*
```

(e) The Final Calculation Using the Potential-Flow Program has the data set name "DAC.EOH3.DPM.J1HB.V3."

```
0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123
//STEP5   EXEC   FORTGO,REGION=380K
//STEPLIB   DD   DSN=DAC.EOH3.DPM.J1HB.V3,DISP=(SHR,PASS),UNIT=3330-1,
//              VOL=SER=CSLB30
//GO.SYSIN  DD   *
//GO.FT01F001    DD   DSN=&FT01,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=(RECFM=VBS,BLKSIZE=6447,BUFNO=1)
//GO.FT02F001    DD   DSN=&FT02,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT03F001    DD   DSN=&FT03,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT04F001    DD   DSN=&FT04,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT07F001    DD   SYSOUT=B
//GO.FT08F001    DD   DSN=&FT08,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT09F001    DD   DSN=&FT09,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT10F001    DD   DSN=&FT10,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT11F001    DD   DSN=&FT11,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT12F001    DD   DSN=&FT12,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT13F001    DD   DSN=&FT13,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT14F001    DD   DSN=&FT14,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT15F001    DD   DSN=&FT15,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT16F001    DD   DSN=&FT16,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT17F001    DD   DSN=&FT17,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT18F001    DD   DSN=&FT18,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT19F001    DD   DSN=&FT19,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT21F001    DD   DSN=&FT21,UNIT=SYSDA,SPACE=(TRK,(50,10)),
//              DCB=*.FT01F001
//GO.FT23F001    DD   DSN=*.STEP4.GO.FT22F001,DISP=(OLD,KEEP)
//GO.FT24F001    DD   DSN=*.STEP1.GO.FT04F001,DISP=(OLD,KEEP)
    ( REPLACE THIS CARD WITH THE INPUT DATA TO THE FINAL P.FLOW PROG. )
/*
//
```

5.0 SAMPLE TEST CASE

The sample test case is an eight-strip swept wing with 30 on-body elements and one wake element per strip. The test case is run at an angle of attack of 8.22° with one plane of symmetry.

The input data and partial output are included. Due to the size of the output from the programs, only the output for the first strip is presented here.

5.1 Input Data

(a) Input Data to the Potential Flow Program. Initial Calculation.

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA
NACA  1                                  1  1      1     1.0      1.0  1.0
 0.989707  0.          0.143106
   30    1   8    0
    0.          2.17        2.80        4.70        6.10       10.00
    8.40        6.80        5.70        0.00
 73.545      46.67       .0          21  72.7162     46.67      -.0752136
 71.8708     46.67      -.149184         70.1221     46.67      -.3016832
 68.2966     46.67      -.4585336        66.3883     46.67      -.602952
 64.3909     46.67      -.7187768        62.2982     46.67      -.7848736
 60.1039     46.67      -.7784504        57.7978     46.67      -.7046872
 55.3756     46.67      -.5412064        54.1159     46.67      -.39886
 53.4756     46.67      -.2913232        53.1503     46.67      -.2119656
 52.9555     46.67      -.1394456        52.825      46.67       .0
 52.9555     46.67       .1394456        53.1503     46.67       .2119656
 53.4756     46.67       .2913232        54.1159     46.67       .39886
 55.3756     46.67       .5412064        57.7978     46.67       .7046872
 60.1039     46.67       .7784504        62.2982     46.67       .7848736
 64.3909     46.67       .7187768        66.3883     46.67       .602952
 68.2966     46.67       .4585336        70.1221     46.67       .3016832
 71.8708     46.67       .149184         72.7162     46.67       .0752136
 73.545      46.67       .0              74.3738     46.67       .0
 72.05       44.5        .0           1  71.1828     44.5       -.078698
 70.2983     44.5       -.156096         68.4685     44.5       -.315661
 66.5585     44.5       -.479778         64.5617     44.5       -.630888
 62.4718     44.5       -.752079         60.2821     44.5       -.821238
 57.9862     44.5       -.814518         55.5732     44.5       -.737337
 53.0388     44.5       -.566282         51.7207     44.5       -.41734
 51.0508     44.5       -.304821         50.7147     44.5       -.221786
 50.5066     44.5       -.145906         50.37       44.5        .0
 50.5066     44.5        .145906         50.7147     44.5        .221786
 51.0508     44.5        .304821         51.7207     44.5        .41734
 53.0388     44.5        .566282         55.5732     44.5        .737337
 57.9862     44.5        .814518         60.2821     44.5        .821238
 62.4718     44.5        .752079         64.5617     44.5        .630888
 66.5585     44.5        .479778         68.4685     44.5        .315661
 70.2983     44.5        .156097         71.1828     44.5        .078689
 72.05       44.5        .0              72.9172     44.5        .0
 70.13       41.7        .0           1  69.2128     41.7       -.083236
 68.2773     41.7       -.165096         66.3420     41.7       -.333861
 64.3218     41.7       -.507441         62.21       41.7       -.667263
 59.9995     41.7       -.795442         57.6836     41.7       -.868588
 55.2553     41.7       -.86148          52.7032     41.7       -.779849
 50.0227     41.7       -.598932         48.6285     41.7       -.441403
 47.92       41.7       -.322396         47.56       41.7       -.234574
 47.3445     41.7       -.154319         47.2        41.7        .0
 47.3445     41.7        .154319         47.56       41.7        .234574
 47.92       41.7        .322396         48.6285     41.7        .441403
 50.0227     41.7        .598932         52.7032     41.7        .779849
 55.2553     41.7        .861480         57.6836     41.7        .868588
 59.9995     41.7        .795442         62.21       41.7        .667263
 64.3218     41.7        .507441         66.3420     41.7        .333861
 68.2773     41.7        .165096         69.2128     41.7        .083236
 70.13       41.7        .0              71.0472     41.7        .0
 66.9        37.0        .0           1  65.8992     37.0       -.090823
 64.8784     37.0       -.180144         62.7667     37.0       -.364291
 60.5624     37.0       -.553693         58.2581     37.0       -.728082
 55.8462     37.0       -.867944         53.3191     37.0       -.947758
 50.6695     37.0       -.940001         47.8848     37.0       -.85093
 44.96       37.0       -.653522         43.4387     37.0       -.481635
 42.6656     37.0       -.351781         42.2728     37.0       -.255955
 42.0376     37.0       -.168385         41.88       37.0        .0
 42.0376     37.0        .168385         42.2728     37.0        .255955
```

(continued)

```
0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123

42.6656   37.0       .351781      43.4387   37.0       .481635
44.96     37.0       .653522      47.8848   37.0       .85093
50.6695   37.0       .940001      53.3191   37.0       .947758
55.8462   37.0       .867944      58.2581   37.0       .728082
60.5624   37.0       .553693      62.7667   37.0       .364291
64.8784   37.0       .180144      65.8992   37.0       .090823
66.9      37.0       .0           67.9008   37.0       .0
62.71     30.90      .0        1  61.6008   30.90     -.1006599
60.4694   30.90     -.199656      58.1290   30.90     -.4037488
55.6860   30.90     -.6136649     53.1321   30.90     -.806943
50.4589   30.90     -.9619537     47.6582   30.90     -1.050412
44.7215   30.90    -1.0418161     41.6352   30.90     -.9430973
38.3936   30.90     -.7243076     36.7076   30.90     -.5338025
35.8507   30.90     -.3898838     35.4154   30.90     -.2836779
35.1547   30.90     -.1866229     34.98     30.90      .0
35.1547   30.90      .1866229     35.4154   30.90      .2836779
35.8507   30.90      .3898838     36.7076   30.90      .5338025
38.3936   30.9       .7243076     41.6352   30.9       .9430973
44.7215   30.9      1.0418161     47.6582   30.9      1.0504124
50.4589   30.9       .9616537     53.1321   30.9       .806943
55.6860   30.9       .6136649     58.1290   30.9       .4037488
60.4694   30.9       .199656      61.6008   30.9       .1006599
62.71     30.9       .0           63.8192   30.9       .0
55.83     20.9       .0        1  54.5432   20.9      -.1167771
53.2307   20.9      -.231624      50.5155   20.9      -.4683952
47.6813   20.9      -.7119221     44.7185   20.9      -.936147
41.6173   20.9     -1.115977      38.3681   20.9     -1.2186
34.9613   20.9     -1.2086269     31.3808   20.9     -1.094102
27.6201   20.9      -.8402804     25.6642   20.9      -.6192725
24.6701   20.9      -.4523102     24.1651   20.9      -.3290991
23.8627   20.9      -.2165041     23.66     20.9       .0
23.8627   20.9       .2165041     24.1651   20.9       .3290991
24.6701   20.9       .4523102     25.6642   20.9       .6192725
27.6201   20.9       .8402804     31.3808   20.9      1.0941017
34.9613   20.9      1.2086269     38.3681   20.9      1.2185996
41.6173   20.9      1.1159773     44.7185   20.9       .936147
47.6813   20.9       .7119221     50.5155   20.9       .4683952
53.2307   20.9       .231624      54.5432   20.9       .1167771
55.83     20.9       .0           57.1168   20.9       .0
50.06     12.5       .0        1  48.6236   12.5      -.1303533
47.1585   12.5      -.258552      44.1277   12.5      -.5228496
40.9640   12.5      -.7946883     37.6567   12.5     -1.044981
34.1950   12.5     -1.245718      30.5681   12.5     -1.360271
26.7652   12.5     -1.349139      22.7684   12.5     -1.221299
18.5705   12.5      -.9379692     16.3872   12.5      -.6912675
15.2776   12.5      -.5048946     14.7138   12.5      -.3673593
14.3762   12.5      -.2416743     14.15     12.5       .0
14.3762   12.5       .2416743     14.7138   12.5       .3673593
15.2776   12.5       .5048946     16.3872   12.5       .6912675
18.5705   12.5       .9379692     22.7684   12.5      1.221299
26.7652   12.5      1.349139      30.5681   12.5      1.36027
34.1950   12.5      1.245718      37.6567   12.5      1.044981
40.9640   12.5       .7946883     44.1277   12.5       .5228496
47.1585   12.5       .258552      48.6236   12.5       .1303533
50.06     12.5       .0           51.4964   12.5       .0
45.39     5.7        .0        1  43.8324   5.7       -.1413522
42.2436   5.7       -.280368      38.9571   5.7       -.5669664
35.5265   5.7       -.8617422     31.9401   5.7       -1.133154
28.1863   5.7       -1.350829     24.2534   5.7       -1.475047
20.1296   5.7       -1.462976     15.7956   5.7       -1.324349
11.2435   5.7       -1.017113      8.8760   5.7       -.749595
7.6727    5.7       -.5474964      7.0614   5.7       -.3983562
6.6953    5.7       -.2620662      6.45     5.7       .0
6.6953    5.7        .2620662      7.0614   5.7       .3983562
7.6727    5.7        .5474964      8.8760   5.7       .749595
11.2435   5.7       1.0171128     15.7956   5.7      1.3243494
20.1296   5.7       1.4629758     24.2534   5.7      1.4750472
28.1863   5.7       1.3508286     31.9401   5.7      1.133154
35.5265   5.7        .8617422     38.9571   5.7       .5669664
42.2436   5.7        .280368      43.8324   5.7       .1413522
45.39     5.7        .0           46.9476   5.7       .0
```

(continued)

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123

 41.47      0.0         .0          1   39.8112    0.0       -.1505361
 38.1192    0.0       -.298584          34.6192    0.0       -.6038
 30.9656    0.0       -0.9177311        27.1463    0.0       -1.20678
 23.1486    0.0       -1.438594         18.9601    0.0       -1.570884
 14.5684    0.0       -1.558028         9.9528     0.0       -1.410395
 5.1050     0.0       -1.083196         2.5836     0.0       -.798298
 1.3022     0.0       -.5830682         .6511      0.0       -.4242381
 .2613      0.0       -.2790931         .0         0.0        .0
 .2613      0.0        .2790931         .6511      0.0        .4242381
 1.3022     0.0        .5830682         2.5835     0.0        .798298
 5.1050     0.0       1.0831964         9.9528     0.0       1.4103947
 14.5684    0.0       1.558028          18.9601    0.0       1.570884
 23.1486    0.0       1.4385943         27.1463    0.0       1.206777
 30.9656    0.0        .9177311         34.6192    0.0        .6038
 38.1192    0.0        .298584          39.8112    0.0        .1505361
 41.47      0.0        .0               43.1288    0.0        .0          3
```

(b) Input Data to the Streamline Calculation Program.

```
 EIGHT STRIPS NACA SWEPT WING. ALPHA=8.2. STREAMLINE CALCULATION.
0                    EIGHT STRIPS NACA SWEPT WING.
10 1 0.0             SET NO. 1 MACH = 0.0
00 1 8.23    0.0     ALPHA-BETA SET NO.1
10 1200              THIS IS THE LOWER SURFACE REGION.
12 2 8.23    0.0     ALPHA-BETA SET NO.2
10 1200              THIS IS THE UPPER SURFACE REGION.
1                    EIGHT STRIPS NACA SWEPT WING.
11 1  0.0                        SET NO.1 MACH = 0.0
01 1 8.23    0.0     ALPHA-BETA SET NO.1
11 12 1                THIS IS THE LOWER SURFACE REGION.
11 2 8.23    0.0     ALPHA-BETA SET NO.2
11 12 1                THIS IS THE UPPER SURFACE REGION.
0 1 1 1000 1                     0       0.999     0.010     0.0010
 1 8                 STREAMLINES FOR THE LOWER SURFACE.
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
1 1 2 1000 1                     0       0.999     0.010     0.0010
 1 8                 STREAMLINES FOR THE UPPER SURFACE.
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
 1 1100               0.02
EIGHT STRIPS NACA SWEPT WING.
  223.3          6700000.0        12.0
```

(c) Input Data to the Boundary-Layer Calculation Program.

```
 Card
Column
 0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123

   16     1     2     0     0     1
    9
    9
    9
    9
    9
    9
   10
   10
   10
   10
   10
   10
    9
    9
    9
    9
```

(d) Input Data to the Back Interpolation Program.

```
NACA 8 STRIP SWEPT WING. BACK INTERPOLATION. BOTH SURFACES.          2
    1     2     3     4    20    22    30     1     0
    1     8   504     1    15
    0.0           46.67          0.0           0.0          42.1256      21.0475
    2     8  1167    16    30
    0.0           46.67         41.713        83.4866     -47.0485     -23.5071
   65     0   517
   62     0   582
   63     0   644
   71     0   707
   69     0   778
   66     0   847
   59     0   913
   18     1   972
   18     1  1180
   43     0  1198
   40     0  1241
   40     0  1281
   41     0  1321
   42     0  1362
   42     0  1404
   41     0  1446
```

(e) Input Data to the Final Calculation in the Potential Flow Program.

```
NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA
NACA  1                     1     1  1     1     1.0      0.0  1.0
 0.989707  0.          0.143106
  30    1    8    0
   0.          2.17        2.80        4.70        6.10       10.00
   8.40        6.80        5.70        0.00
```

5.2 Output Data

The output data from the test case consists of the output from these programs:

1. The initial potential-flow calculation (pp 41 - 49).
2. The streamline calculation (pp 50 - 68).
3. The small cross-flow boundary-layer calculation (pp 69 - 73).
4. The final potential-flow computation (pp 74 - 82).

Output of the first strip from this eight-strip test case is used here as a sample. Similarly, the first streamline output of the lower surface of the wing is selected in both streamline calculation and the boundary-layer calculation.

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

---------- * ----------

CASE ID	---	NACA
LIFTING SECTIONS	---	1
KUTTA POINTS	---	0
OFF - BODY POINTS	---	0
UNIFORM ONSET FLOWS	---	1
IGNORE ELEMENT	---	0
MOMENT INPUT	---	0
SPECIAL LAST WAKE CALCULATION	---	1
PARTIAL EXECUTION	---	0
PIECEWISE LINEAR VORTICITY	---	0
STEP FUNCTION VORTICITY	---	1
SYMMETRY	---	1
BOUNDARY LAYER CALCULATION	---	-1
INTERMEDIATE OUTPUT	---	0
PARABOLIC VORTICITY OPTION	----	0

(NONZEROS IMPLIED OPTIONS WERE SELECTED)

FOOT CONVERTER FACTOR INPUT ---- 1.0

COMPONENTS OF THE UNIFORM ONSET FLOWS

(1) 0.989707, 0.0 , 0.143106

---------- * ----------

OTHER INPUT INFORMATION WILL BE WRITTEN ELSEWHERE IN THE OUTPUT.

---------- * ----------

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

---------- * ----------

BEGIN THE SUBROUTINE INPUT . TIME IS 0.029 SEC.

BEGIN THE FORMATION OF ELEMENTS. TIME IS 0.071 SEC.

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

N	M	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	1	73.544958 46.665598 0.0	72.716202 46.665598 -0.075214	71.182800 44.500000 -0.078698	72.050003 44.500000 0.0	0.090204 -0.062146 -0.993982	72.367767 45.576797 -0.033484	2.2352E-07 3.2086E+00 1.8513E+00	LIFT
	2	72.716202 46.665598 -0.075214	71.870804 46.665598 -0.149184	70.298294 44.500000 -0.156096	71.182800 44.500000 -0.078698	0.087012 -0.059888 -0.994405	71.511154 45.576813 -0.114817	1.9334E-06 3.2499E+00 1.8875E+00	
	3	71.870804 46.665598 -0.149184	70.122101 46.665598 -0.301683	68.468506 44.500000 -0.315661	70.298294 44.500000 -0.156096	0.086721 -0.059677 -0.994444	70.183807 45.576782 -0.230695	5.3644E-07 4.0388E+00 3.9043E+00	
	4	70.122101 46.665598 -0.301683	68.296600 46.665598 -0.458534	66.558502 44.500000 -0.479778	68.468506 44.500000 -0.315661	0.085461 -0.058716 -0.994610	68.355011 45.576797 -0.388980	1.6093E-06 4.1761E+00 4.0750E+00	
	5	68.296600 46.665598 -0.458534	66.388306 46.665598 -0.602952	64.561707 44.500000 -0.630888	66.558502 44.500000 -0.479778	0.075365 -0.050617 -0.995871	66.444534 45.576782 -0.543130	1.6093E-06 4.3230E+00 4.2546E+00	
	6	66.388306 46.665598 -0.602952	64.390900 46.665598 -0.718777	62.471802 44.500000 -0.752079	64.561707 44.500000 -0.630888	0.057854 -0.035854 -0.997681	64.446091 45.576797 -0.676289	1.0133E-06 4.4800E+00 4.4450E+00	
	7	64.390900 46.665598 -0.718777	62.298203 46.665598 -0.784874	60.232104 44.500000 -0.821238	62.471802 44.500000 -0.752079	0.031566 -0.012578 -0.999423	62.353302 45.576797 -0.769373	4.3958E-07 4.6477E+00 4.6491E+00	
	8	62.298203 46.665598 -0.784874	60.103857 46.665598 -0.778450	57.986206 44.500000 -0.814518	60.282104 44.500000 -0.821238	-0.002927 0.019474 -0.999806	60.159805 45.576797 -0.799906	3.1292E-07 4.8273E+00 4.8728E+00	
	9	60.103857 46.665598 -0.778450	57.797806 46.665598 -0.704687	55.573196 44.500000 -0.737337	57.986206 44.500000 -0.814518	-0.031933 0.047757 -0.998348	57.857056 45.576782 -0.758877	1.0543E-06 5.0237E+00 5.1287E+00	
	10	57.797806 46.665598 -0.704687	55.375595 46.665598 -0.541206	53.038803 44.500000 -0.566282	55.573196 44.500000 -0.737337	-0.067103 0.083750 -0.994225	55.437744 45.576797 -0.637487	2.9802E-07 5.2322E+00 5.4091E+00	
	11	55.375595 46.665598 -0.541206	54.115906 46.665598 -0.398860	51.720703 44.500000 -0.417340	53.038803 44.500000 -0.566282	-0.111313 0.131253 -0.985080	53.553802 45.576782 -0.481004	1.4193E-06 4.2523E+00 2.8393E+00	
	12	54.115906 46.665598 -0.398860	53.475601 46.665598 -0.291323	51.050797 44.500000 -0.304823	51.720703 44.500000 -0.417340	-0.162687 0.187817 -0.968637	52.581665 45.576813 -0.353146	2.3022E-06 3.7567E+00 3.4676E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

N	M	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	13	53.475601 46.665998 -0.291323	53.150299 46.665998 -0.211966	50.714706 44.500000 -0.221786	51.050797 44.500000 -0.304821	-0.230079 0.262701 -0.937045	52.091080 45.578964 -0.257506	2.4332E-04 3.5123E+00 7.6581E-01	LIFT
	14	53.150299 46.665998 -0.211966	52.955505 46.665998 -0.139446	50.506607 44.500000 -0.145906	50.714706 44.500000 -0.221786	-0.321739 0.365381 -0.873488	51.818832 45.573502 -0.179819	3.3668E-04 3.4209E+00 5.0045E-01	
	15	52.955505 46.665998 -0.139446	52.824997 46.665998 0.0	50.369995 44.500000 0.0	50.506607 44.500000 -0.145906	-0.562892 0.636812 -0.526899	51.654938 45.576752 -0.071350	2.6077E-08 3.3783E+00 5.5002E-01	
	16	52.824997 46.665998 0.0	52.955505 46.665998 0.139446	50.506607 44.500000 0.145906	50.369995 44.500000 0.0	-0.562892 0.636812 0.526899	51.654938 45.576752 0.071350	1.1612E-05 3.3733E+00 5.5002E-01	
	17	52.955505 46.665998 0.139446	53.150299 46.665998 0.211966	50.714706 44.500000 0.221786	50.506607 44.500000 0.145906	-0.321739 0.365381 0.873488	51.818832 45.573502 0.179819	3.3597E-04 3.4209E+00 5.0045E-01	
	18	53.150299 46.665998 0.211966	53.475601 46.665998 0.291323	51.050797 44.500000 0.304821	50.714706 44.500000 0.221786	-0.230079 0.262701 0.937045	52.091080 45.578964 0.257506	2.4031E-04 3.5123E+00 7.6380E-01	
	19	53.475601 46.665998 0.291323	54.115906 46.665998 0.398860	51.720703 44.500000 0.417340	51.050797 44.500000 0.304821	-0.162687 0.187817 0.968637	52.581665 45.576813 0.353146	2.7232E-06 3.7567E+00 1.4676E+00	
	20	54.115906 46.665998 0.398860	55.375595 46.665998 0.541206	53.038803 44.500000 0.566282	51.720703 44.500000 0.417340	-0.111313 0.131253 0.985080	53.553802 45.576782 0.481004	1.0729E-06 4.2523E+00 2.8393E+00	
	21	55.375595 46.665998 0.541206	57.797806 46.665998 0.704687	55.573196 44.500000 0.737337	53.038803 44.500000 0.566282	-0.067103 0.083750 0.994225	55.437744 45.576797 0.637487	1.4901E-06 5.2322E+00 5.4091E+00	
	22	57.797806 46.665998 0.704687	60.103897 46.665998 0.778450	57.586206 44.500000 0.814518	55.573196 44.500000 0.737337	-0.031933 0.047757 0.998349	57.357056 45.576782 0.758977	1.5274E-07 5.0237E+00 5.1287E+00	
	23	60.103897 46.665998 0.778450	62.298203 46.665998 0.784874	60.282104 44.500000 0.821238	57.986206 44.500000 0.814518	-0.002927 0.019474 0.999806	60.159805 45.576797 0.799906	2.9802E-08 4.8273E+00 4.8728E+00	
	24	62.298203 46.665998 0.784874	64.390900 46.665998 0.718777	62.471802 44.500000 0.7520	60.282104 44.500000 0.821238	0.031966 -0.012578 0.999423	62.353302 45.576797 0.769373	1.2219E-06 .6477E+00 .6491E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

N	M	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	25	64.390900 46.665558 0.718777	66.388306 46.665558 0.602952	64.561707 44.500000 0.630888	62.471802 44.500000 0.752079	0.057854 -0.035854 0.997681	64.446091 45.576797 0.676239	5.5879E-07 4.4800E+00 4.4450E+00	LIFT
	26	66.388306 46.665558 0.602952	68.296600 46.665558 0.458534	66.558502 44.500000 0.479778	64.561707 44.500000 0.630888	0.075365 -0.050617 0.995871	66.444534 45.576782 0.543130	1.0096E-06 4.3230E+00 4.2546E+00	
	27	68.296600 46.665558 0.458534	70.122101 46.665558 0.301683	68.468506 44.500000 0.315661	66.558502 44.500000 0.479778	0.085461 -0.058716 0.994610	68.355011 45.576797 0.388980	1.7881E-06 4.1761E+00 4.0750E+00	
	28	70.122101 46.665558 0.301683	71.870804 46.665558 0.149184	70.298294 44.500000 0.156097	68.468506 44.500000 0.315661	0.086721 -0.059676 0.994444	70.183807 45.576782 0.230696	2.5630E-06 4.0388E+00 3.9043E+00	
	29	71.870804 46.665558 0.149184	72.716202 46.665558 0.075214	71.182800 44.500000 0.078689	70.298294 44.500000 0.156097	0.087018 -0.059894 0.994405	71.511154 45.576813 0.114815	3.8370E-06 3.2499E+00 1.8875E+00	
	30	72.716202 46.665558 0.075214	73.544558 46.665558 0.0	72.050003 44.500000 0.0	71.182800 44.500000 0.078689	0.090198 -0.062144 0.993983	72.367767 45.576797 0.033482	2.3581E-06 3.2086E+00 1.8513E+00	
	31	73.544558 46.665558 0.0	74.373795 46.665558 0.0	72.917206 44.500000 0.0	72.050003 44.500000 0.0	0.0 0.0 1.000000	73.215927 45.576797 0.0	0.0 3.1795E+00 1.8402E+00	WAKE
2	1	72.050003 44.500000 0.0	71.182800 44.500000 -0.078698	69.212799 41.699997 -0.083236	70.130005 41.699997 0.0	0.090206 -0.061855 -0.994001	70.634796 43.086914 -0.040494	1.2368E-06 3.9870E+00 2.5132E+00	LIFT
	2	71.182800 44.500000 -0.078698	70.298294 44.500000 -0.156096	68.277298 41.699997 -0.165096	69.212799 41.699997 -0.083236	0.087016 -0.059610 -0.994422	69.733444 43.086914 -0.120813	8.6054E-07 4.0360E+00 2.5623E+00	
	3	70.298294 44.500000 -0.156096	68.468506 44.500000 -0.315661	66.341995 41.699997 -0.333861	68.277298 41.699997 -0.165096	0.086721 -0.059397 -0.994460	68.336807 43.086914 -0.242742	7.1526E-07 4.0501E+00 5.3005E+00	
	4	68.468506 44.500000 -0.315661	66.558502 44.500000 -0.479778	64.321793 41.699997 -0.507441	66.341995 41.699997 -0.333861	0.085462 -0.058442 -0.994626	66.412491 43.086899 -0.409292	1.3113E-06 5.0072E+00 5.5320E+00	
	5	66.558502 44.500000 -0.479778	64.561707 44.500000 -0.630888	62.210007 41.699997 -0.6672	64.321793 41.699997 -0.507441	0.075367 -0.050364 -0.995883	64.402267 43.086929 -0.571491	3.1590E-06 4.1754E+00 .7758E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

UNIFORM ONSET FLOW = (0.589707E+00, 0.0 , 0.143106E+00)

FINAL OUTPUT FOR THE FOLLOWING ANGLE OF ATTACK

(0.989707, 0.0 0.143106)

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

UNIFORM ONSET FLOW = (0.589707E+00, 0.0 , 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	DCX DCY DCZ	NX NY NZ	SIG VN AREA
1	1	72.367767 45.576797 -0.038484	0.920055 0.081061 0.078433	0.926943 0.859224 0.140776	0.992569 0.087450 0.084614	0.090204 -0.062146 -0.993982	0.051469 -0.000005 1.951276
	2	71.511154 45.576813 -0.114817	0.961679 0.128246 0.076430	0.973199 0.947116 0.052884	0.988163 0.131778 0.078535	0.087012 -0.059888 -0.994405	0.059954 -0.000005 1.887482
	3	70.183807 45.576782 -0.230695	0.984394 0.212920 0.073066	1.009805 1.019705 -0.019705	0.974836 0.210853 0.072357	0.086721 -0.059677 -0.994444	0.066622 0.000001 3.904346
	4	68.355011 45.576797 -0.388980	1.004082 0.281521 0.059665	1.045124 1.092285 -0.092285	0.960730 0.269366 0.066657	0.085461 -0.058716 -0.994610	0.071559 -0.000010 4.074961
	5	66.444534 45.576782 -0.543130	1.012349 0.313622 0.060679	1.061550 1.126889 -0.126889	0.953652 0.295439 0.057161	0.075365 -0.050617 -0.995871	0.075454 -0.000007 4.254564
	6	64.446091 45.576797 -0.676289	1.015050 0.330298 0.046998	1.068471 1.141631 -0.141631	0.950002 0.309132 0.043986	0.057854 -0.035854 -0.997681	0.079986 -0.000007 4.445014
	7	62.353302 45.576797 -0.769373	1.011863 0.347382 0.027595	1.070188 1.145301 -0.145301	0.945500 0.324599 0.025785	0.031566 -0.012578 -0.999423	0.086462 -0.000008 4.649075
	8	60.159805 45.576797 -0.799906	0.996553 0.373315 0.004361	1.064190 1.132500 -0.132500	0.936443 0.350797 0.004098	-0.002927 0.019474 -0.999806	0.096157 -0.000007 4.872804
	9	57.857056 45.576782 -0.758877	0.973117 0.402201 -0.011879	1.053025 1.108863 -0.108863	0.924116 0.381948 -0.011281	-0.031933 0.047757 -0.998348	0.108779 -0.000007 5.128668
	10	55.437744 45.576797 -0.697487	0.925633 0.439529 -0.025432	1.025002 1.050629 -0.050629	0.903055 0.428808 -0.024812	-0.067103 0.083750 -0.994225	0.126999 -0.000017 5.409143
	11	53.553802 45.576782 -0.481004	0.872209 0.448480 -0.038784	0.981522 0.963386 0.036614	0.888628 0.456923 -0.039514	-0.111213 0.131753 -0.985080	0.143994 -0.000018 2.839258

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

UNIFORM ONSET FLOW = (0.989707E+00, 0.0 , 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	DCX DCY DCZ	NX NY NZ	SIG VN AREA
1	12	52.581665 45.576813 -0.353146	0.747094 0.477825 -0.032808	0.887436 0.787542 0.212458	0.841857 0.538433 -0.036970	-0.162687 0.187817 -0.968637	0.154319 -0.000019 1.467604
	13	52.091080 45.579864 -0.257506	0.581113 0.604600 0.026836	0.839020 0.703954 0.296046	0.692609 0.720603 0.031985	-0.230079 0.262701 -0.937045	0.160093 -0.000019 0.765805
	14	51.918832 45.573502 -0.179819	0.392131 0.791562 0.186705	0.902930 0.815228 0.184772	0.434302 0.876711 0.206784	-0.321739 0.365381 -0.873488	0.159595 -0.000019 0.500452
	15	51.654938 45.576752 -0.071350	0.178215 1.014112 1.035309	1.460153 2.132046 -1.132046	0.122052 0.694524 0.709041	-0.552892 0.636812 -0.526899	0.147971 -0.000020 0.550022
	16	51.654938 45.576752 0.071350	-1.281613 -0.242063 1.661635	2.112382 4.462158 -3.462158	0.606715 -0.114592 0.786617	-0.552892 0.636812 0.526899	-0.041480 -0.000045 0.550021
	17	51.918832 45.573502 0.179819	1.552354 -0.545828 0.800115	1.829731 3.347914 -2.347914	0.848405 -0.298311 0.437286	-0.321739 0.365381 0.873488	-0.116154 0.000003 0.500452
	18	52.091080 45.579864 0.257506	1.453803 -0.425370 0.476219	1.587850 2.521265 -1.521265	0.915580 -0.267890 0.299914	-0.230079 0.262701 0.937045	-0.129534 0.000003 0.765804
	19	52.581665 45.576813 0.353146	1.353722 -0.286667 0.282958	1.412375 1.994803 -0.994803	0.958471 -0.202968 0.200342	-0.162687 0.187817 0.968637	-0.133890 0.000010 1.467603
	20	53.553802 45.576782 0.481004	1.248807 -0.144275 0.160350	1.267299 1.606045 -0.606045	0.985408 -0.113845 0.126529	-0.111313 0.131253 0.985080	-0.124717 0.000013 2.839258
	21	55.437744 45.576797 0.637487	1.151564 -0.107118 0.086759	1.159783 1.345098 -0.345098	0.992913 -0.092360 0.074807	-0.067103 0.083750 0.994225	-0.105873 0.000014 5.409146
	22	57.857056 45.576782 0.758877	1.101443 -0.113484 0.040674	1.108020 1.227709 -0.227709	0.994065 -0.102420 0.036709	-0.031933 0.047757 0.998348	-0.089066 0.000015 9.128668

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. P.KUTTA

UNIFORM ONSET FLOW = (0.589707E+00, 0.0 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	DCX DCY DCZ	NX NY NZ	SIG VN AREA
1	23	60.155805 45.576797 0.799906	1.079902 -0.121326 0.005539	1.086710 1.180938 -0.180938	0.993735 -0.111645 0.005097	-0.002927 0.019474 0.999806	-0.079678 0.000015 4.872804
	24	62.353302 45.576797 0.769373	1.054834 -0.115364 -0.034754	1.061692 1.127191 -0.127191	0.993541 -0.108661 -0.032734	0.031566 -0.012578 0.999423	-0.076396 0.000014 4.649075
	25	64.446091 45.576797 0.676289	1.027301 -0.101651 -0.063210	1.034250 1.069674 -0.069674	0.993281 -0.098285 -0.061117	0.057854 -0.035854 0.997681	-0.075651 0.000014 4.445014
	26	66.444534 45.576782 0.543130	1.001915 -0.084749 -0.080116	1.008679 1.017433 -0.017433	0.993294 -0.084020 -0.079427	0.075365 -0.050617 0.995871	-0.076049 0.000014 4.254566
	27	68.355011 45.576797 0.388560	0.979023 -0.067501 -0.088103	0.985324 0.970863 0.029137	0.993636 -0.068506 -0.089415	0.085461 -0.058716 0.994610	-0.076769 0.000006 4.074959
	28	70.183807 45.576782 0.230696	0.961886 -0.055582 -0.087206	0.967429 0.935918 0.064082	0.994270 -0.057454 -0.090142	0.086721 -0.059676 0.994444	-0.075698 0.000011 3.904346
	29	71.511154 45.576813 0.114815	0.946126 -0.046083 -0.085578	0.951105 0.904601 0.095399	0.994765 -0.048453 -0.089977	0.087018 -0.059894 0.994405	-0.071717 -0.000009 1.887482
	30	72.367767 45.576797 0.038492	0.922717 -0.025123 -0.085327	0.926995 0.859319 0.140681	0.995386 -0.027101 -0.092047	0.090198 -0.062144 0.993983	-0.064498 -0.000025 1.351291

************ ************ ************

THE FORCE COMPONENTS OF THIS STRIP ARE -0.248032E+01 0.293418E+01 0.726421E+01

THE MOMENT COMPONENTS OF THIS STRIP ARE 0.330461E+03 -0.365636E+03 0.266708E+03

************ ************ ************

2	1	70.634796 43.388514 -0.040494	0.919066 0.085312 0.079472	0.926330 0.858087 0.141913	0.992159 0.092097 0.084497	0.090206 -0.061855 -0.994001	0.077949 -0.000174 2.513225

```
STREAMLINE NUMBER  1
 IPRINT=  1    ISAVE= 1    ISTART= 1    ISTAG= 0    ISMODE= 0
 IPANL =  0    L =    0    DELTAS=    0.0200    XSI=    1.0932    YSI=    0.4258    ZSI=    0.0

      IST          S          A(1)          A(2)          A(3)          VSTAG       DATA(I), I=1,21

 ICYCLE =  1  X, Y, Z =       72.368652     45.576431     -0.038452

 ICYCLE =  2  X, Y, Z =       72.419434     45.179031     -0.013687

 ICYCLE =  3  X, Y, Z =       72.342041     45.973770     -0.066086

      1          0.0          0.023424      0.019767      0.0           0.957564
    0.306011     0.833059    52.221207     45.577759     -0.287838     -0.727545     -0.686047     -0.012112
   72.353652    45.576431    -0.033452     -0.996567      0.685791     -0.921387      0.071045      0.918457
    0.082031     0.089344     1.092539      0.425064     -0.996826      0.0          -0.086182      0.010986
    0.996750    -0.061035     0.087967     -0.060837     -0.994873
      DN, DK, D, RK =        0.253635     -0.026030     -0.037953     -0.148856

 ICYCLE =  1  X, Y, Z =       71.961426     45.544418     -0.071182

 ICYCLE =  2  X, Y, Z =       71.984375     45.145889     -0.044342

 ICYCLE =  3  X, Y, Z =       71.936279     45.949875     -0.100861

 DV =        0.320253  DDTT =        0.777651
 VS(1) TO VS(9)       0.957510    0.306844    0.832545   52.186554   45.545746   -0.288265   -0.727657   -0.685946   -0.012061

      2          0.020000     0.024110      0.037257      0.0           0.957510
    0.306844     0.832545    52.186554     45.545746     -0.288265     -0.727557     -0.685946     -0.012061
   71.961426    45.544418    -0.071182     -0.996552      0.682373     -0.934814      0.085693      0.938721
    0.097900     0.090320     1.124531      0.812561     -0.993164      0.0          -0.034473      0.010498
    0.996811    -0.062744     0.086227     -0.059280     -0.991943
      DN, DK, D, RK =        0.261400     -0.017061      0.003155      0.012044

 ICYCLE =  1  X, Y, Z =       71.561035     45.502975     -0.105453

 ICYCLE =  2  X, Y, Z =       71.583008     45.094742     -0.076172

 ICYCLE =  3  X, Y, Z =       71.519287     45.917358     -0.136261

 DV =        0.322629  DDTT =        0.792695
 VS(1) TO VS(9)       0.957439    0.307945    0.831868   52.141693   45.504227   -0.288826   -0.727804   -0.685787   -0.011994

      3          0.040000     0.024999      0.054810      0.0           0.957439
    0.307945     0.831868    52.141693     45.504227     -0.288826     -0.727804     -0.685787     -0.011994
   71.561035    45.502975    -0.105453     -0.997025      0.684326     -0.956543      0.107178      0.956055
    0.122605     0.097158     1.166013      1.135760     -0.995605      0.0          -0.034229      0.009521
    0.993949    -0.061279     0.085739     -0.059143     -0.994141
      DN, DK, D, RK =        0.280975     -0.023259      0.031799      0.112788

 ICYCLE =  1  X, Y, Z =       71.149438     45.451309     -0.139359

 ICYCLE =  2  X, Y, Z =       71.187500     45.034698     -0.108841

 ICYCLE =  3  X, Y, Z =       71.093475     45.870453     -0.170486
```

```
     4          0.080000     0.026105     0.072403     0.0          0.957343
 0.3033         0.831109    52.085961    45.452530    -0.289534    -0.727987    -0.685595    -  311909
71.143433      -0.451309    -0.139359    -0.996429     0.688232    -0.972900     0.135986     0.963135
 0.147705       0.314717     1.217656     1.562790    -1.001465     0.0         -0.082275     0.010696
 0.995704      -0.095654     0.084412    -0.057739    -0.997559
    DN, DK, D, RK =          0.295750    -0.035074     0.026215     0.088021

ICYCLE =  1  X, Y, Z =       70.729034    45.389359    -0.172180

ICYCLE =  2  X, Y, Z =       70.784286    44.967545    -0.141174

ICYCLE =  3  X, Y, Z =       70.659225    45.810959    -0.204285

DV =        0.867413  DDTT =        0.819008
VS(1) TO VS(9)       0.957237    0.311043    0.829961   52.018997   45.390533   -0.290395   -0.728216   -0.685340   -0.011806

     5          0.080000     0.027432     0.089824     0.0          0.957237
 0.311043       0.829961    52.018997    45.390533    -0.290395    -0.728215    -0.685340    -0.011806
70.729034      45.389359    -0.172180    -0.996658     0.687012    -0.977295     0.155029     0.971924
 0.166992       0.083934     1.279588     1.941666    -0.999755     0.0         -0.082520     0.009949
 0.996902      -0.057617     0.084442    -0.057877    -0.995850
    DN, DK, D, RK =          0.306987    -0.047392     0.024772     0.079750

ICYCLE =  1  X, Y, Z =       70.304550    45.318237    -0.204529

ICYCLE =  2  X, Y, Z =       70.368866    44.894196    -0.173492

ICYCLE =  3  X, Y, Z =       70.224503    45.741913    -0.237534

DV =        0.850091  DDTT =        0.830203
VS(1) TO VS(9)       0.957107    0.313032    0.828736   51.942245   45.319351   -0.291397   -0.728480   -0.685054   -0.011686

     6          0.100000     0.028956     0.107016     0.0          0.957107
 0.313032       0.828736    51.942245    45.319351    -0.291397    -0.728480    -0.685054    -0.011686
70.304550      45.318237    -0.204529    -0.996658     0.686279    -0.981201     0.174805     0.977295
 0.187256       0.083252     1.350730     2.318814    -0.998291     0.0         -0.083054     0.010010
 0.995357      -0.057129     0.084351    -0.057877    -0.995605
    DN, DK, D, RK =          0.313677    -0.055292     0.027012     0.084807

ICYCLE =  1  X, Y, Z =       69.877213    45.238647    -0.236984

ICYCLE =  2  X, Y, Z =       69.952606    44.811920    -0.204773

ICYCLE =  3  X, Y, Z =       69.791916    45.664566    -0.270477

DV =        0.833009  DDTT =        0.840354
VS(1) TO VS(9)       0.956958    0.315290    0.827347   51.856491   45.239716   -0.292532   -0.728779   -0.684730   -0.011549

     7          0.120000     0.030660     0.123948     0.0          0.956958
 0.315290       0.827347    51.856491    45.239716    -0.292532    -0.728779    -0.684730    -0.011549
69.877213      45.238647    -0.236984    -0.996262     0.689453    -0.987061     0.197266     0.977051
 0.207275       0.081787     1.430272     2.691864    -1.002441     0.0         -0.082199     0.010529
 0.995445      -0.053955     0.084259    -0.057678    -0.998047
    DN, DK, D, RK =          0.320499    -0.062656     0.017365     0.053173

ICYCLE =  1  X, Y, Z =       69.451035    45.153198    -0.268753

ICYCLE =  2  X, Y, Z =       69.528778    44.724930    -0.236176

ICYCLE =  3  X, Y, Z =       69.362549    45.580551    -0.302612
```

```
        8          0.140000     0.032493     0.140727     0.0          0.956795
    0.3177         0.825331    51.764329    45.154099    -0.293766    -0.729105    -0.684376    -  011401
   69.451035     45.153153    -0.268753    -0.996780     0.685303    -0.987061     0.200195     0.985840
    0.212402      0.081009     1.515807     3.061629    -0.997314     0.0         -0.084152     0.008911
    0.997055     -0.057861     0.085266    -0.058777    -0.994873
      DN, DK, D, RK =        0.325336    -0.065222     0.018835      0.056713

ICYCLE =   1  X, Y, Z =       69.022385     45.063583     -0.300735

ICYCLE =   2  X, Y, Z =       69.101852     44.633255     -0.267838

ICYCLE =   3  X, Y, Z =       68.930298     45.493073     -0.334824

DV =          0.799222  DOTT =          0.852537
VS(1) TO VS(9)       0.956621     0.320363     0.824226    51.667877    45.064438    -0.295071    -0.729450    -0.684002    -0.011243

        9          0.160000     0.034412     0.157399     0.0          0.956621
    0.320363       0.824226    51.667877    45.064438    -0.295071    -0.729450    -0.684002    -0.011243
   69.022385     45.063533    -0.300735    -0.996964     0.684326    -0.990479     0.208008     0.989502
    0.220703      0.080185     1.605374     3.430333    -0.996826     0.0         -0.084412     0.008881
    0.997192     -0.058338     0.085800    -0.059036    -0.994629
      DN, DK, D, RK =        0.331318    -0.068056     0.022115      0.065382

ICYCLE =   1  X, Y, Z =       68.591339     44.971451     -0.332703

ICYCLE =   2  X, Y, Z =       68.674240     44.539200     -0.299286

ICYCLE =   3  X, Y, Z =       68.493851     45.403397     -0.366821

DV =          0.782413  DOTT =          0.855136
VS(1) TO VS(9)       0.956441     0.323071     0.822560    51.568832    44.972321    -0.296424    -0.729809    -0.683613    -0.011080

       10          0.180000     0.036384     0.174028     0.0          0.956441
    0.323071       0.822560    51.568832    44.972321    -0.296424    -0.729309    -0.683613    -0.011080
   68.591339     44.971451    -0.332703    -0.997162     0.684326    -0.993896     0.214355     0.993652
    0.227051      0.079346     1.697428     3.799624    -0.996826     0.0         -0.084793     0.008377
    0.997406     -0.059082     0.085754    -0.059280    -0.994385
      DN, DK, D, RK =        0.337945    -0.072502     0.025385      0.073446

ICYCLE =   1  X, Y, Z =       68.158798     44.877060     -0.364258

ICYCLE =   2  X, Y, Z =       68.242294     44.442474     -0.331100

ICYCLE =   3  X, Y, Z =       68.059769     45.310715     -0.398300

DV =          0.765653  DOTT =          0.857658
VS(1) TO VS(9)       0.956254     0.325870     0.820838    51.467209    44.877731    -0.297823    -0.730180    -0.683211    -0.010911

       11          0.200000     0.038409     0.190601     0.0          0.956254
    0.325870       0.820338    51.467209    44.877731    -0.297823    -0.730180    -0.683211    -0.010911
   68.158798     44.877060    -0.364258    -0.997406     0.682861    -0.995117     0.216797     0.998291
    0.229736      0.079422     1.791912     4.169279    -0.994629     0.0         -0.084763     0.007523
    0.997620     -0.060791     0.085693    -0.059494    -0.993164
      DN, DK, D, RK =        0.343326    -0.073953     0.027350      0.077876

ICYCLE =   1  X, Y, Z =       67.723236     44.781174     -0.395844

ICYCLE =   2  X, Y, Z =       67.809555     44.344193     -0.362747

ICYCLE =   3  X, Y, Z =       67.624878     45.216446     -0.429413
```

```
    12          0.219999     0.042463     0.207157     0.0          0.956063
 0.3397        0.819181    51.364136    44.781769    -0.299249    -0.730559    -0.682891    -  .010739
67.723239     44.781174    -0.395844    -0.997253     0.682861    -0.998779     0.221436     0.999756
 0.233643      0.078574     1.887771     4.539919    -0.995850     0.0         -0.083420     0.007843
 0.997498     -0.059814     0.084747    -0.058289    -0.993408
    DN, DK, D, RK =        0.347952    -0.075543     0.021664     0.060843

ICYCLE =  1  X, Y, Z =      67.286652    44.684616    -0.427185

ICYCLE =  2  X, Y, Z =      67.373199    44.246231    -0.394379

ICYCLE =  3  X, Y, Z =      67.187531    45.121735    -0.460266

DV =       0.732170  DOTT =       0.859686
VS(1) TO VS(9)    0.955869    0.331610    0.817307   51.260391   44.685195   -0.300691   -0.730942   -0.682385   -0.010564

    13          0.239999     0.042530     0.223700     0.0          0.955869
 0.331610      0.817307    51.260391    44.685196    -0.300691    -0.730942    -0.682335    -0.010564
67.286652     44.684616    -0.427185    -0.997574     0.682861    -1.000244     0.220703     1.002441
 0.232666      0.077301     1.884282     4.911503    -0.995361     0.0         -0.083008     0.007156
 0.997787     -0.059838     0.083832    -0.057892    -0.993652
    DN, DK, D, RK =        0.352173    -0.076470     0.022478     0.062373

ICYCLE =  1  X, Y, Z =      66.848816    44.588577    -0.458023

ICYCLE =  2  X, Y, Z =      66.933853    44.148834    -0.426117

ICYCLE =  3  X, Y, Z =      66.747696    45.027069    -0.490753

DV =       0.715412  DOTT =       0.859142
VS(1) TO VS(9)    0.955676    0.334485    0.815538   51.157120   44.589005   -0.302131   -0.731325   -0.681970   -0.010389

    14          0.259999     0.044589     0.240264     0.0          0.955675
 0.334485      0.815538    51.157120    44.589005    -0.302131    -0.731325    -0.681970    -0.010389
65.848816     44.588577    -0.458023    -0.997971     0.681641    -0.999512     0.216064     1.005371
 0.229980      0.075516     2.083367     5.285130    -0.993164     0.0         -0.081787     0.006104
 0.998138     -0.059814     0.082809    -0.057022    -0.992188
    DN, DK, D, RK =        0.355975    -0.076955     0.028703     0.073811

ICYCLE =  1  X, Y, Z =      66.408020    44.492401    -0.488754

ICYCLE =  2  X, Y, Z =      66.496323    44.050552    -0.456879

ICYCLE =  3  X, Y, Z =      66.308594    44.932022    -0.520264

DV =       0.698565  DOTT =       0.858885
VS(1) TO VS(9)    0.955482    0.337362    0.813769   51.053711   44.492561   -0.303574   -0.731709   -0.681554   -0.010214

    15          0.279999     0.046651     0.256817     0.0          0.955482
 0.337362      0.813769    51.053711    44.492661    -0.303574    -0.731709    -0.681554    -0.010214
65.408020     44.492401    -0.488754    -0.997467     0.684082    -1.003906     0.220459     1.003174
 0.232422      0.073776     2.176598     5.660091    -0.997070     0.0         -0.079208     0.006927
 0.997696     -0.055176     0.080154    -0.054611    -0.995117
    DN, DK, D, RK =        0.359980    -0.078258     0.020397     0.055516

ICYCLE =  1  X, Y, Z =      65.966949    44.397354    -0.518600

ICYCLE =  2  X, Y, Z =      66.052414    43.954651    -0.487915

ICYCLE =  3  X, Y, Z =      65.866653    44.838593    -0.549149

DV =       0.681875  DOTT =       0.857937
```

```
   12          0.219999     0.042463     0.207157     0.0          0.956063
 0.3287        0.819081    51.364136    44.781769    -0.299249    -0.730559    -0.682801    -  010738
67.723239     44.731174    -0.395844    -0.997253     0.682861    -0.998779     0.221436     0.999756
 0.233643      0.078574     1.887771     4.539919    -0.995850     0.0          -0.083420     0.007843
 0.997498     -0.059814     0.084747    -0.058289    -0.993408
   DN, DK, D, RK =         0.347952    -0.075543     0.021664     0.060843

ICYCLE =  1  X, Y, Z =      67.286652    44.684616    -0.427185

ICYCLE =  2  X, Y, Z =      67.373199    44.246231    -0.394379

ICYCLE =  3  X, Y, Z =      67.187531    45.121735    -0.460266

DV =        0.732170  DDTT =       0.859686
VS(1) TO VS(9)          0.955869     0.331610     0.817307    51.260391    44.685196    -0.300691    -0.730942    -0.682385    -0.010564

   13          0.239999     0.042530     0.223700     0.0          0.955869
 0.331610      0.817307    51.260391    44.685196    -0.300691    -0.730942    -0.682335    -0.010564
67.286652     44.684616    -0.427185    -0.997574     0.682961    -1.000244     0.220723     1.003441
 0.232665      0.077301     1.884282     4.911503    -0.995361     0.0          -0.083008     0.007156
 0.997787     -0.059838     0.083832    -0.057892    -0.993652
   DN, DK, D, RK =         0.352173    -0.076470     0.022478     0.062373

ICYCLE =  1  X, Y, Z =      66.848816    44.588577    -0.458023

ICYCLE =  2  X, Y, Z =      66.933853    44.148834    -0.426117

ICYCLE =  3  X, Y, Z =      66.747696    45.027069    -0.490753

DV =        0.715412  DDTT =       0.859142
VS(1) TO VS(9)          0.955676     0.334485     0.815538    51.157120    44.589005    -0.302131    -0.731325    -0.681970    -0.010389

   14          0.259999     0.044589     0.240264     0.0          0.955676
 0.334485      0.815538    51.157120    44.589005    -0.302131    -0.731325    -0.681970    -0.010389
65.848816     44.588577    -0.458023    -0.997971     0.681641    -0.999512     0.216064     1.005371
 0.229980      0.075516     2.080367     5.285130    -0.993164     0.0          -0.081787     0.006104
 0.998138     -0.059814     0.082809    -0.057022    -0.992188
   DN, DK, D, RK =         0.355975    -0.076955     0.028703     0.073811

ICYCLE =  1  X, Y, Z =      66.408020    44.492401    -0.488754

ICYCLE =  2  X, Y, Z =      66.496323    44.050552    -0.456879

ICYCLE =  3  X, Y, Z =      66.308594    44.932022    -0.520264

DV =        0.698565  DDTT =       0.858885
VS(1) TO VS(9)          0.955482     0.337362     0.813769    51.053711    44.492561    -0.303574    -0.731709    -0.681554    -0.010214

   15          0.279999     0.046651     0.256817     0.0          0.955482
 0.337362      0.813769    51.053711    44.492661    -0.303574    -0.731709    -0.681554    -0.010214
65.408020     44.492401    -0.488754    -0.997467     0.684082    -1.003906     0.220459     1.003174
 0.232422      0.073776     2.176598     5.660091    -0.997070     0.0          -0.079208     0.006927
 0.997696     -0.055176     0.080154    -0.054611    -0.995117
   DN, DK, D, RK =         0.359980    -0.078258     0.020397     0.055516

ICYCLE =  1  X, Y, Z =      65.966949    44.397354    -0.518600

ICYCLE =  2  X, Y, Z =      66.052414    43.954651    -0.487915

ICYCLE =  3  X, Y, Z =      65.866653    44.838593    -0.549149
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    16          0.299399     0.048685     0.273417     0.0          0.955292
 0.3401         0.812027    50.551691    44.397629    -0.304998    -0.732088    -0.681143    -  .010042
65.9669--      44.337354    -0.518600    -0.997910     0.683105    -1.002930     0.216064     1.004639
 0.229004       0.072250     2.271552     6.037398    -0.996338     0.0          -0.077545     0.006485
 0.998108      -0.055176     0.078400    -0.053329    -0.994385
    DN, DK, D, RK =          0.361958    -0.077665     0.026715     0.072154

ICYCLE =  1  X, Y, Z =       65.525223    44.302887    -0.547806

ICYCLE =  2  X, Y, Z =       65.608765    43.858643    -0.518295

ICYCLE =  3  X, Y, Z =       65.426102    44.744888    -0.577240

DV =          0.565383  DDTT =          0.857479
VS(1) TO VS(9)     0.955102     0.342996     0.810301    50.850204    44.303115    -0.306413    -0.732465    -0.680734    -0.009870

    17          0.319959     0.050708     0.290020     0.0          0.955102
 0.342996       0.810301    50.850204    44.303116    -0.306413    -0.732465    -0.680734    -0.009870
65.525223      44.302887    -0.547806    -0.998444     0.681641    -1.002930     0.210205     1.008545
 0.223633       0.069275     2.366004     6.416003    -0.993408     0.0          -0.076233     0.004745
 0.998672      -0.054688     0.076660    -0.052124    -0.993652
    DN, DK, D, RK =          0.364888    -0.076446     0.028320     0.075965

ICYCLE =  1  X, Y, Z =       65.080643    44.209244    -0.576447

ICYCLE =  2  X, Y, Z =       65.166229    43.763306    -0.547760

ICYCLE =  3  X, Y, Z =       64.984253    44.652161    -0.604279

DV =          0.643264  DDTT =          0.856238
VS(1) TO VS(9)     0.954916     0.345761     0.808600    50.749466    44.209320    -0.307814    -0.732838    -0.680330    -0.009700

    18          0.339999     0.052716     0.306652     0.0          0.954916
 0.345761       0.808600    50.749466    44.209320    -0.307814    -0.732838    -0.680330    -0.009700
65.080643      44.209244    -0.576447    -0.999199     0.683105    -1.005127     0.209961     1.006348
 0.222168       0.066696     2.459732     6.796583    -0.996094     0.0          -0.072495     0.005173
 0.998444      -0.051025     0.073593    -0.049377    -0.994873
    DN, DK, D, RK =          0.367121    -0.076521     0.020187     0.053830

ICYCLE =  1  X, Y, Z =       64.635468    44.116501    -0.604095

ICYCLE =  2  X, Y, Z =       64.718872    43.669418    -0.576782

ICYCLE =  3  X, Y, Z =       64.539551    44.560898    -0.630615

DV =          0.631430  DDTT =          0.855467
VS(1) TO VS(9)     0.954733     0.348474     0.806930    50.649811    44.116501    -0.309194    -0.733206    -0.679931    -0.009533

    19          0.359999     0.054702     0.323303     0.0          0.954733
 0.348474       0.806930    50.649811    44.116501    -0.309194    -0.733206    -0.679931    -0.009533
64.635468      44.116501    -0.604095    -0.998383     0.683838    -1.006104     0.206543     1.007080
 0.219238       0.064224     2.552443     7.178964    -0.996338     0.0          -0.069626     0.005234
 0.998535      -0.049072     0.070801    -0.047058    -0.995972
    DN, DK, D, RK =          0.369628    -0.075602     0.023155     0.061373

ICYCLE =  1  X, Y, Z =       64.180484    44.024994    -0.630646

ICYCLE =  2  X, Y, Z =       64.271790    43.576920    -0.604767

ICYCLE =     X, Y, Z =       64.095795    44.470306    -0.655533
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    20          0.379999     0.056663     0.339986     0.0          0.954554
 0.3511         0.805297    50.551361    44.024918    -0.310550    -0.733358    -0.679539    -  009368
64.189484      44.024934    -0.631646    -0.998627     0.682861    -1.005371     0.203369     1.008423
 0.214981       0.052775     2.643994     7.563289    -0.995850     0.0         -0.066956     0.004578
 0.998749      -0.047363     0.063008    -0.044708    -0.995758
    DN, DK, D, RK =          0.371425    -0.074246     0.021168     0.055885

ICYCLE =  1  X, Y, Z =       63.742676    43.936096    -0.656418

ICYCLE =  2  X, Y, Z =       63.823212    43.486969    -0.631805

ICYCLE =  3  X, Y, Z =       63.650925    44.382431    -0.679398

DV =          0.597645  DOTT =          0.851497
VS(1) TO VS(9)          0.954383    0.353672    0.803729    50.455780    43.936005    -0.311858    -0.733917    -0.679161    -0.009209

    21          0.399999     0.055566     0.356738     0.0          0.954383
 0.353672       0.803729    50.455780    43.936005    -0.311858    -0.733917    -0.679161    -0.009209
63.742676      43.936096    -0.656418    -0.999100     0.682922    -1.005981     0.197256     1.009491
 0.208847       0.053594     2.732956     7.949965    -0.995361     0.0         -0.064911     0.003235
 0.999329      -0.046166     0.065384    -0.042603    -0.996140
    DN, DK, D, RK =          0.373924    -0.072827     0.020837     0.054698

ICYCLE =  1  X, Y, Z =       63.294662    43.849121    -0.680893

ICYCLE =  2  X, Y, Z =       63.373306    43.398758    -0.657944

ICYCLE =  3  X, Y, Z =       63.204666    44.296417    -0.701996

DV =          0.580670  DOTT =          0.849426
VS(1) TO VS(9)          0.954217    0.356130    0.802215    50.362167    43.848969    -0.313129    -0.734256    -0.678793    -0.009055

    22          0.419999     0.060430     0.373547     0.0          0.954217
 0.356130       0.802215    50.362167    43.848969    -0.313129    -0.734256    -0.678793    -0.009055
63.294662      43.849121    -0.680893    -0.999130     0.683533    -1.006622     0.192703     1.009415
 0.204529       0.055923     2.319850     8.338796    -0.995575     0.0         -0.060928     0.003281
 0.999268      -0.041626     0.061661    -0.039368    -0.995972
    DN, DK, D, RK =          0.375543    -0.071324     0.021188     0.055428

ICYCLE =  1  X, Y, Z =       62.845566    43.763626    -0.704132

ICYCLE =  2  X, Y, Z =       62.923218    43.312057    -0.682953

ICYCLE =  3  X, Y, Z =       62.757477    44.211472    -0.723480

DV =          0.563658  DOTT =          0.847860
VS(1) TO VS(9)          0.954057    0.358513    0.800747    50.270020    43.763305    -0.314370    -0.734586    -0.678435    -0.008905

    23          0.439999     0.062263     0.390399     0.0          0.954057
 0.358513       0.800747    50.270020    43.763306    -0.314370    -0.734585    -0.678435    -0.008905
62.845566      43.763626    -0.704132    -0.999237     0.683716    -1.006668     0.188843     1.010361
 0.199768       0.053116     2.905445     8.729668    -0.996765     0.0         -0.056870     0.003052
 0.999329      -0.033406     0.057968    -0.036057    -0.996735
    DN, DK, D, RK =          0.377003    -0.070198     0.019816     0.051675

ICYCLE =  1  X, Y, Z =       62.396103    43.679749    -0.725952

ICYCLE =  2  X, Y, Z =       62.471161    43.227676    -0.706833

ICYCLE =  3  X, Y, Z =       62.307770    44.128464    -0.743290
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```
   24          0.459958     0.064058     0.407291     0.0          0.953903
 0.3608        0.799334    50.179779    43.679520    -0.315573    -0.734207    -0.678087    -  008759
62.396103     43.679749    -0.725952    -0.999599     0.682678    -1.006012     0.184021     1.011459
 0.196213      0.049728     2.539215     9.122714    -0.995453     0.0         -0.053711     0.002350
 0.999816     -0.036438     0.054428    -0.033112    -0.995468
   DN, DK, D, RK =         0.378699    -0.069155     0.024792     0.064402

ICYCLE =  1  X, Y, Z =      61.945313    43.597198    -0.746401

ICYCLE =  2  X, Y, Z =      62.020187    43.144180    -0.729063

ICYCLE =  3  X, Y, Z =      61.857971    44.046478    -0.761514

DV =        0.529559  DOTT =        0.844819
VS(1) TO VS(9)      0.953754    0.363022    0.797966    50.090714    43.596893    -0.316745    -0.735220    -0.677748    -0.008617

   25          0.479958     0.065827     0.424195     0.0          0.953754
 0.363022      0.797966    50.090714    43.596893    -0.316745    -0.735220    -0.677748    -0.008617
61.945313     43.597198    -0.746401    -0.999632     0.683746    -1.006653     0.185501     1.009369
 0.195953      0.045533     3.071814     9.517174    -0.997116     0.0         -0.049072     0.001999
 0.999769     -0.031738     0.052018    -0.029266    -0.997620
   DN, DK, D, RK =         0.380020    -0.068775     0.023499     0.060849

ICYCLE =  1  X, Y, Z =      61.494186    43.514633    -0.765044

ICYCLE =  2  X, Y, Z =      61.568726    43.061096    -0.749942

ICYCLE =  3  X, Y, Z =      61.409058    43.964188    -0.777720

DV =        0.512540  DOTT =        0.845112
VS(1) TO VS(9)      0.953609    0.365191    0.796629    50.001648    43.514252    -0.317903    -0.735528    -0.677413    -0.008476

   26          0.459998     0.067595     0.441069     0.0          0.953609
 0.365191      0.796629    50.001648    43.514252    -0.317903    -0.735528    -0.677413    -0.008476
61.494186     43.514633    -0.765044    -0.999858     0.683136    -1.004608     0.181656     1.009537
 0.192368      0.041916     3.154391     9.912170    -0.996155     0.0         -0.045227     0.001205
 0.999961     -0.027435     0.045761    -0.025482    -0.996689
   DN, DK, D, RK =         0.380582    -0.067541     0.020168     0.052178

ICYCLE =  1  X, Y, Z =      61.342084    43.433563    -0.782093

ICYCLE =  2  X, Y, Z =      61.114883    42.979675    -0.769109

ICYCLE =  3  X, Y, Z =      60.959122    43.883408    -0.792180

DV =        0.495502  DOTT =        0.843511
VS(1) TO VS(9)      0.953471    0.367266    0.795348    49.914154    43.433197    -0.319024    -0.735827    -0.677089    -0.008341

   27          0.519958     0.069331     0.457969     0.0          0.953471
 0.367266      0.795348    49.914154    43.433197    -0.319024    -0.735827    -0.677089    -0.008341
61.042084     43.433563    -0.782093    -0.999791     0.683960    -1.004333     0.180008     1.006500
 0.189590      0.033376     3.235431    10.308584    -0.997833     0.0         -0.039659     0.001756
 0.999881     -0.021896     0.040716    -0.020877    -0.997498
   DN, DK, D, RK =         0.380295    -0.065802     0.019413     0.050299

ICYCLE =  1  X, Y, Z =      60.590515    43.354767    -0.797062

ICYCLE =  2  X, Y, Z =      60.661041    42.900787    -0.786687

ICYCLE =  3  X, Y, Z =      60.509109    43.804276    -0.804682
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    28          0.539988     0.071019     0.474906     0.0          0.953340
 0.3692         0.794137    49.823964    43.354370    -0.320096    -0.736113    -0.676779    -0.008211
60.593542      43.354767    -0.797062    -0.999990     0.682861    -1.001572     0.173248     1.007599
 0.183197       0.033730     3.314235    10.706526    -0.995338     0.0         -0.035208     0.000917
 1.000088      -0.018905     0.035793    -0.016512    -0.997162
    DN, DK, D, RK =        0.379589    -0.063873     0.020796     0.054026

ICYCLE =  1  X, Y, Z =      60.138626    43.278030    -0.810355

ICYCLE =  2  X, Y, Z =      60.207581    42.823746    -0.802413

ICYCLE =  3  X, Y, Z =      60.056244    43.727661    -0.815115

DV =        0.461349  DDTT =        0.839128
VS(1) TO VS(9)       0.953218    0.371076    0.792994    49.745956    43.277634    -0.321121    -0.736386    -0.676483    -0.008087

    29          0.559958     0.072662     0.491869     0.0          0.953218
 0.371076       0.792994    49.745956    43.277634    -0.321121    -0.736386    -0.676483    -0.008087
60.133626      43.278030    -0.810355    -1.000192     0.683283    -1.001022     0.170059     1.005137
 0.180532       0.027921     3.390976    11.105815    -0.996942     0.0         -0.029936     0.000686
 1.000257      -0.014270     0.030634    -0.011815    -0.998270
    DN, DK, D, RK =        0.380079    -0.063609     0.025462     0.066071

ICYCLE =  1  X, Y, Z =      59.687256    43.201569    -0.821165

ICYCLE =  2  X, Y, Z =      59.756638    42.747833    -0.815872

ICYCLE =  3  X, Y, Z =      59.604263    43.650330    -0.823319

DV =        0.444320  DDTT =        0.839197
VS(1) TO VS(9)       0.953101    0.372850    0.791896    49.663116    43.201096    -0.322121    -0.736652    -0.676194    -0.007966

    30          0.579958     0.074300     0.508781     0.0          0.953101
 0.372850       0.791896    49.663116    43.201096    -0.322121    -0.736652    -0.676194    -0.007966
59.687256      43.201569    -0.821165    -1.000324     0.683533    -0.997514     0.171616     1.003158
 0.181326       0.023903     3.467454    11.505165    -0.996765     0.0         -0.024723     0.000073
 1.000454      -0.009247     0.025046    -0.006709    -0.998127
    DN, DK, D, RK =        0.378633    -0.063800     0.025883     0.067409

ICYCLE =  1  X, Y, Z =      59.236389    43.123627    -0.830061

ICYCLE =  2  X, Y, Z =      59.307007    42.670502    -0.827366

ICYCLE =  3  X, Y, Z =      59.153183    43.571533    -0.829651

DV =        0.427443  DDTT =        0.841277
VS(1) TO VS(9)       0.952988    0.374573    0.790829    49.578491    43.123154    -0.323114    -0.736916    -0.675906    -0.007846

    31          0.599958     0.075971     0.525545     0.0          0.952988
 0.374573       0.790829    49.578491    43.123154    -0.323114    -0.736916    -0.675906    -0.007846
59.236389      43.123627    -0.830061    -1.000436     0.683517    -0.994095     0.172352     1.000259
 0.183182       0.018229     3.545439    11.902753    -0.996262     0.0         -0.018772    -0.000533
 1.000462      -0.003391     0.019298    -0.001433    -0.997803
    DN, DK, D, RK =        0.377032    -0.064145     0.024110     0.063042

ICYCLE =  1  X, Y, Z =      58.786072    43.044952    -0.836946

ICYCLE =  2  X, Y, Z =      58.857071    42.592880    -0.836845

ICYCLE =  3  X, Y, Z =      58.703552    43.492081    -0.833816
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      32          0.619998     0.077554     0.542196     0.0          0.952884
   0.3761         0.788329    49.493057    43.044571    -0.324075    -0.737173    -0.675628      0.007730
  58.786072      43.044952    -0.836946    -1.000343     0.683273    -0.990952     0.173615      0.995575
   0.182098       0.013657     3.624023    12.299152    -0.997269     0.0         -0.012802     -0.000576
   1.000397       0.001526     0.013336     0.004114    -0.998047
     DN, DK, D, RK =          0.374670    -0.063777     0.022108     0.059170

ICYCLE =  1  X, Y, Z =        58.336639    42.966888    -0.841841

ICYCLE =  2  X, Y, Z =        58.407928    42.515305    -0.844280

ICYCLE =  3  X, Y, Z =        58.255249    43.413132    -0.836181

DV =          0.394012  DDTT =          0.842148
VS(1) TO VS(9)          0.952789    0.377668    0.788906    49.407959    42.966431    -0.324993    -0.737417    -0.675363    -0.007619

      33          0.639998     0.079327     0.558777     0.0          0.952789
   0.377668       0.788906    49.407959    42.966431    -0.324993    -0.737417    -0.675363     -0.007619
  58.336639      42.966388    -0.841841    -1.000402     0.683319    -0.987274     0.170074      0.992981
   0.178665       0.008759     3.702142    12.695103    -0.996948     0.0         -0.007355     -0.000549
   1.000423       0.007385     0.007785     0.009398    -0.997665
     DN, DK, D, RK =          0.372939    -0.063200     0.019668     0.051996

ICYCLE =  1  X, Y, Z =        57.888016    42.890259    -0.844842

ICYCLE =  2  X, Y, Z =        57.958755    42.439682    -0.849741

ICYCLE =  3  X, Y, Z =        57.807327    43.335464    -0.836633

DV =          0.377386  DDTT =          0.840819
VS(1) TO VS(9)          0.952703    0.379035    0.788055    49.324371    42.889862    -0.325864    -0.737649    -0.675110    -0.007514

      34          0.659998     0.080568     0.575318     0.0          0.952703
   0.379035       0.788055    49.324371    42.889862    -0.325864    -0.737649    -0.675110     -0.007514
  57.888016      42.890259    -0.844842    -1.000325     0.683777    -0.983612     0.168259      0.988464
   0.175217       0.003540     3.778753    13.090943    -0.997238     0.0         -0.001846     -0.000885
   1.000364       0.013046     0.002197     0.014618    -0.998795
     DN, DK, D, RK =          0.370417    -0.062426     0.019383     0.051600

ICYCLE =  1  X, Y, Z =        57.440643    42.814102    -0.845961

ICYCLE =  2  X, Y, Z =        57.510620    42.364807    -0.853297

ICYCLE =  3  X, Y, Z =        57.360352    43.257965    -0.835346

DV =          0.360344  DDTT =          0.840680
VS(1) TO VS(9)          0.952623    0.380324    0.787250    49.241089    42.813629    -0.326710    -0.737875    -0.674865    -0.007412

      35          0.679998     0.082601     0.591779     0.0          0.952623
   0.380324       0.787250    49.241089    42.813629    -0.326710    -0.737875    -0.674865     -0.007412
  57.440643      42.814102    -0.845961    -1.000235     0.683365    -0.979782     0.167034      0.984263
   0.174301      -0.001053     3.854989    13.485831    -0.997223     0.0          0.003265     -0.000732
   1.000312       0.018692    -0.003021     0.019531    -0.998276
     DN, DK, D, RK =          0.367204    -0.061619     0.020017     0.053761

ICYCLE =  1  X, Y, Z =        56.995010    42.736832    -0.845225

ICYCLE =  2  X, Y, Z =        57.065399    42.288879    -0.855008

ICYCLE =  3  X, Y, Z =        56.912277    43.178986    -0.832158
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```
   36          0.659993     0.084256     0.608101     0.0          0.952546
 0.3815        0.736473    49.156540    42.736359    -0.327546    -0.738097    -0.674623    -  007311
55.995010     42.736322    -0.845225    -1.000292     0.682190    -0.974838     0.169495     0.580698
 0.176620     -0.004608     3.932275    13.878719    -0.997009     0.0          0.007751    -0.000748
 1.000282      0.022125    -0.007706     0.024048    -0.997971
    DN, DK, D, RK =        0.364117    -0.062505     0.023724     0.064217

ICYCLE =  1  X, Y, Z =      56.550415    42.657349    -0.842773

ICYCLE =  2  X, Y, Z =      56.622711    42.210754    -0.854950

ICYCLE =  3  X, Y, Z =      56.466400    43.098083    -0.827316

DV =        0.323253  DDTT =        0.845427
VS(1) TO VS(9)      0.952472    0.382784    0.785711    49.069534    42.556967    -0.328388    -0.738321    -0.674380    -0.007210

   37          0.719997     0.085558     0.624219     0.0          0.952472
 0.382784      0.785711    49.069534    42.556967    -0.328388    -0.738321    -0.674380    -0.007210
56.550415     42.657349    -0.842773    -1.000122     0.683014    -0.970200     0.174927     0.975250
 0.179764     -0.003209     4.011756    14.268753    -0.997269     0.0          0.012604    -0.000534
 1.000031      0.027354    -0.012314     0.028534    -0.998108
    DN, DK, D, RK =        0.351261    -0.063586     0.022634     0.061705

ICYCLE =  1  X, Y, Z =      56.107407    42.576736    -0.838638

ICYCLE =  2  X, Y, Z =      56.180878    42.131775    -0.853119

ICYCLE =  3  X, Y, Z =      56.022949    43.015717    -0.820663

DV =        0.312234  DDTT =        0.847198
VS(1) TO VS(9)      0.952401    0.383960    0.784974    48.981262    42.576385    -0.329222    -0.738542    -0.674139    -0.007110

   38          0.739997     0.087684     0.640167     0.0          0.952401
 0.383960      0.784974    48.981262    42.576385    -0.329222    -0.738542    -0.674139    -0.007110
56.107407     42.576736    -0.838633    -0.999969     0.681900    -0.964675     0.175339     0.970245
 0.181503     -0.011322     4.092357    14.656632    -0.996628     0.0          0.016876    -0.000320
 1.000000      0.031577    -0.016617     0.032791    -0.997833
    DN, DK, D, RK =        0.357638    -0.063876     0.021338     0.058727

ICYCLE =  1  X, Y, Z =      55.665543    42.496002    -0.832748

ICYCLE =  2  X, Y, Z =      55.740692    42.052933    -0.849686

ICYCLE =  3  X, Y, Z =      55.581192    42.933197    -0.812408

DV =        0.295346  DDTT =        0.847689
VS(1) TO VS(9)      0.952334    0.385083    0.784268    48.892776    42.495789    -0.330041    -0.738759    -0.673903    -0.007012

   39          0.759997     0.089411     0.655988     0.0          0.952334
 0.385083      0.784268    48.892776    42.495789    -0.330041    -0.738759    -0.673903    -0.007012
55.665543     42.496002    -0.832748    -0.999741     0.682755    -0.959808     0.176798     0.964294
 0.182007     -0.014404     4.173000    15.042536    -0.997818     0.0          0.021255     0.000107
 0.999741      0.036606    -0.020905     0.037033    -0.997894
    DN, DK, D, RK =        0.353651    -0.064214     0.018151     0.050498

ICYCLE =  1  X, Y, Z =      55.225464    42.414932    -0.825241

ICYCLE =  2  X, Y, Z =      55.301376    41.973801    -0.844543

ICYCLE =  3  X, Y, Z =      55.141190    42.849808    -0.802612
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    40          0.779997     0.091149     0.671659     0.0          0.952270
 0.3361         0.733593    48.803696    42.414673    -0.330848    -0.738973    -0.673670    - .006916
55.225464      42.414932    -0.825241    -0.999664     0.683105    -0.954376     0.176910     0.956497
 0.180328      -0.018036     4.254144    15.426766    -0.998016     0.0          0.025513     0.000580
 0.999603       0.040573    -0.024994     0.041061    -0.998489
    DN, DK, D, RK =        0.348956    -0.064056     0.016762     0.047245

ICYCLE =  1  X, Y, Z =      54.787766    42.334030    -0.816055

ICYCLE =  2  X, Y, Z =      54.863815    41.895081    -0.837646

ICYCLE =  3  X, Y, Z =      54.703156    42.766464    -0.791183

DV =        0.265014  DOTT =        0.848950
VS(1) TO VS(9)      0.952210    0.387191    0.782941   48.714783   42.333801   -0.331638   -0.739181   -0.673443   -0.006821

    41          0.799997     0.092882     0.687197     0.0          0.952210
 0.387191       0.782941    48.714783    42.333801    -0.331638    -0.739181    -0.673443    -0.006821
54.787766      42.334030    -0.816055    -0.999527     0.681458    -0.947311     0.174911     0.950241
 0.179092      -0.020798     4.235062    15.809109    -0.997375     0.0          0.029190     0.000763
 0.999481       0.044152    -0.023931     0.044952    -0.997360
    DN, DK, D, RK =        0.343924    -0.063713     0.017132     0.048979

ICYCLE =  1  X, Y, Z =      54.352921    42.251892    -0.805435

ICYCLE =  2  X, Y, Z =      54.429840    41.815384    -0.829285

ICYCLE =  3  X, Y, Z =      54.265717    42.681580    -0.778259

DV =        0.249627  DOTT =        0.851089
VS(1) TO VS(9)      0.952153    0.388189    0.782311   48.624527   42.251724   -0.332425   -0.739389   -0.673217   -0.006728

    42          0.819997     0.094641     0.702526     0.0          0.952153
 0.388189       0.782311    48.624527    42.251724    -0.332425    -0.739389    -0.673217    -0.006728
54.352921      42.251812    -0.805435    -0.999329     0.682358    -0.940735     0.181396     0.941132
 0.184097      -0.023895     4.417166    16.187668    -0.998352     0.0          0.033539     0.000931
 0.999237       0.049362    -0.033066     0.049149    -0.998596
    DN, DK, D, RK =        0.338808    -0.064680     0.020222     0.058626

ICYCLE =  1  X, Y, Z =      53.921265    42.166809    -0.793533

ICYCLE =  2  X, Y, Z =      53.999680    41.732574    -0.819626

ICYCLE =  3  X, Y, Z =      53.830444    42.593521    -0.763977

DV =        0.234536  DOTT =        0.855292
VS(1) TO VS(9)      0.952097    0.389177    0.781686   48.530899   42.166733   -0.333227   -0.739599   -0.672988   -0.006633

    43          0.839997     0.096463     0.717562     0.0          0.952097
 0.389177       0.781686    48.530899    42.166733    -0.333227    -0.739599    -0.672988    -0.006633
53.921255      42.166809    -0.793533    -0.999252     0.683121    -0.933441     0.188232     0.932541
 0.191284      -0.027161     4.502235    16.561172    -0.999512     0.0          0.037308     0.000977
 0.999161       0.053116    -0.037094     0.053116    -0.997971
    DN, DK, D, RK =        0.334095    -0.066346     0.024140     0.070870

ICYCLE =  1  X, Y, Z =      53.492249    42.077621    -0.780441

ICYCLE =  2  X, Y, Z =      53.574524    41.646408    -0.808701

ICYCLE =  3  X, Y, Z =      53.397842    42.500977    -0.748627
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   44          0.859997     0.098375     0.732244     0.0          0.952042
 0.3901        0.781059    48.432587    42.077499    -0.334053    -0.739816    -0.672752    -  006535
53.422244     42.077521    -0.780441    -0.998947     0.683350    -0.925354     0.196045     0.922089
 0.199509     -0.029617     4.591505    16.929199    -0.999756     0.0          0.041809     0.001434
 0.998901      0.058044    -0.041489     0.057480    -0.998657
    DN, DK, D, RK =        0.328367    -0.068714     0.023783     0.070893

ICYCLE =  1  X, Y, Z =      53.066589    41.985794    -0.766159

ICYCLE =  2  X, Y, Z =      53.152557    41.558014    -0.796616

ICYCLE =  3  X, Y, Z =      52.969589    42.405090    -0.732361

DV =        0.205374  DOTT =        0.864534
VS(1) TO VS(9)      0.951990    0.391137    0.780442   48.331451   41.985764   -0.334887   -0.740033   -0.672514   -0.006437

   45          0.879997     0.100341     0.746615     0.0          0.951990
 0.391137      0.780442    48.331451    41.985764    -0.334887    -0.740033    -0.672514    -0.006437
53.066589     41.985794    -0.766159    -0.998825     0.682892    -0.915680     0.201416     0.912704
 0.204681     -0.032608     4.683274    17.292252    -0.999512     0.0          0.046051     0.001495
 0.998749      0.063034    -0.045578     0.061829    -0.998428
    DN, DK, D, RK =        0.321553    -0.070383     0.022080     0.067077

ICYCLE =  1  X, Y, Z =      52.644150    41.891129    -0.750900

ICYCLE =  2  X, Y, Z =      52.733658    41.466797    -0.783386

ICYCLE =  3  X, Y, Z =      52.545563    42.305984    -0.715271

DV =        0.191288  DOTT =        0.868581
VS(1) TO VS(9)      0.951939    0.392090    0.779835   48.226974   41.891113   -0.335732   -0.740253   -0.672274   -0.006338

   46          0.859997     0.102370     0.760651     0.0          0.951939
 0.392090      0.779835    48.226974    41.891113    -0.335732    -0.740253    -0.672274    -0.006338
52.644150     41.891129    -0.750900    -0.998520     0.682373    -0.905685     0.206299     0.903015
 0.209000     -0.034988     4.778000    17.650253    -0.998779     0.0          0.050446     0.002243
 0.999444      0.067123    -0.050064     0.066330    -0.997589
    DN, DK, D, RK =        0.313931    -0.071391     0.019085     0.059279

ICYCLE =  1  X, Y, Z =      52.225601    41.794479    -0.734756

ICYCLE =  2  X, Y, Z =      52.317795    41.374435    -0.769104

ICYCLE =  3  X, Y, Z =      52.126251    42.204605    -0.697433

DV =        0.177512  DOTT =        0.871841
VS(1) TO VS(9)      0.951890    0.393013    0.779246   48.120499   41.794693   -0.336578   -0.740472   -0.672035   -0.006239

   47          0.919997     0.104437     0.774378     0.0          0.951890
 0.393013      0.779246    48.120499    41.794693    -0.336578    -0.740472    -0.672035    -0.006239
52.225601     41.794479    -0.734756    -0.998032     0.680893    -0.894835     0.211670     0.891937
 0.213226     -0.036392     4.874492    18.002945    -0.998535     0.0          0.055557     0.003220
 0.997940      0.071834    -0.054886     0.071320    -0.996826
    DN, DK, D, RK =        0.304873    -0.071523     0.015971     0.051000

ICYCLE =  1  X, Y, Z =      51.811386    41.695847    -0.717880

ICYCLE =  2  X, Y, Z =      51.905243    41.280075    -0.753891

ICYCLE =  3  X, Y, Z =      51.711884    42.100647    -0.679031
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    48          0.939997     0.106552     0.787773     0.0          0.951844
 0.3939         0.773571    48.011444    41.695999    -0.337429    -0.740692    -0.671796    -  006141
51.911380      41.695347    -0.717880    -0.997681     0.679199    -0.883301     0.214111     0.882690
 0.215195      -0.038132     4.973233    18.350174    -0.996338     0.0          0.059814     0.003723
 0.997574       0.075912    -0.059433     0.076111    -0.995026
    DN, DK, D, RK =        0.295254    -0.070738     0.013783      0.045397

ICYCLE =  1  X, Y, Z =      51.402145    41.595505    -0.700241

ICYCLE =  2  X, Y, Z =      51.497482    41.184692    -0.737946

ICYCLE =  3  X, Y, Z =      51.301132    41.995148    -0.659866

DV =        0.150950  DOTT =        0.878495
VS(1) TO VS(9)      0.951802    0.394778    0.778115    47.900650    41.595795    -0.338278    -0.740909    -0.671558    -0.006043

    49          0.959997     0.108701     0.800851     0.0          0.951802
 0.394778       0.778115    47.900650    41.595795    -0.338278    -0.740909    -0.671558    -0.006043
51.402145      41.595505    -0.700241    -0.997192     0.677490    -0.871094     0.218750     0.873260
 0.213521      -0.038818     5.073517    18.691437    -0.994385     0.0          0.064850     0.004684
 0.997040       0.079346    -0.064240     0.081055    -0.992920
    DN, DK, D, RK =        0.285308    -0.070333     0.013850      0.047134

ICYCLE =  1  X, Y, Z =      50.998047    41.492645    -0.682159

ICYCLE =  2  X, Y, Z =      51.095154    41.086563    -0.721420

ICYCLE =  3  X, Y, Z =      50.895767    41.886703    -0.640091

DV =        0.133204  DOTT =        0.882736
VS(1) TO VS(9)      0.951761    0.395622    0.777573    47.786880    41.492950    -0.339135    -0.741128    -0.671320    -0.005944

    50          0.979996     0.110904     0.813557     0.0          0.951761
 0.395622       0.777573    47.786880    41.492950    -0.339135    -0.741123    -0.671320    -0.005944
50.998047      41.492645    -0.682159    -0.996567     0.674805    -0.858398     0.222412     0.865814
 0.221603      -0.038925     5.176391    19.025909    -0.991943     0.0          0.069794     0.006058
 0.996429       0.082520    -0.069000     0.086151    -0.990311
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```
     IST          S          A(1)          A(2)          A(3)          VSTAG        DATA(I), I=1,21
     DN, DK, D, RK =        0.275268      -0.069833      0.013347      0.046997

 ICYCLE =  1  X, Y, Z =      50.559365      41.387329      -0.663452

 ICYCLE =  2  X, Y, Z =      50.697220      40.586404      -0.704285

 ICYCLE =  3  X, Y, Z =      50.494614      41.775452      -0.619507

 DV =          0.125837  DDTT =          0.886977
 VS(1) TO VS(9)        0.951723      0.396440      0.777045      47.670242      41.387650      -0.339997      -0.741346      -0.671081      -0.005846

     51          0.999996      0.113162      0.825886      0.0           0.951723
   0.396440      0.777045     47.670242     41.387650     -0.339997     -0.741346     -0.671081     -0.005846
  50.599365     41.387329     -0.663452     -0.995941      0.672119     -0.845215      0.226807      0.858017
   0.227295     -0.038406      5.281795     19.353455     -0.988525      0.0           0.075119      0.007034
   0.995834      0.086670     -0.074051      0.091446     -0.987457
     DN, DK, D, RK =        0.264978      -0.069253      0.016343      0.059673

 ICYCLE =  1  X, Y, Z =      50.205643      41.279419      -0.644287

 ICYCLE =  2  X, Y, Z =      50.305527      40.884323      -0.686661

 ICYCLE =  3  X, Y, Z =      50.097488      41.661743      -0.598038

 DV =          0.113857  DDTT =          0.891261
 VS(1) TO VS(9)        0.951687      0.397233      0.776532      47.550873      41.279892      -0.340865      -0.741565      -0.670843      -0.005748

     52          1.019996      0.115472      0.837830      0.0           0.951687
   0.397233      0.776532     47.550873     41.279892     -0.340865     -0.741565     -0.670843     -0.005748
  50.205643     41.279419     -0.644287     -0.995224      0.669678     -0.831787      0.234131      0.847916
   0.234619     -0.037933      5.389631     19.674240     -0.986572      0.0           0.080765      0.008530
   0.995132      0.090038     -0.079224      0.097000     -0.985779
     DN, DK, D, RK =        0.254716      -0.069469      0.018495      0.070051

 ICYCLE =  1  X, Y, Z =      49.917383      41.168625      -0.624405

 ICYCLE =  2  X, Y, Z =      49.919693      40.779175      -0.668747

 ICYCLE =  3  X, Y, Z =      49.705353      41.545258      -0.575912

 DV =          0.102290  DDTT =          0.895964
 VS(1) TO VS(9)        0.951654      0.398004      0.776032      47.428116      41.169144      -0.341742      -0.741783      -0.670604      -0.005650

     53          1.039994      0.117846      0.849364      0.0           0.951654
   0.398004      0.776032     47.428116     41.169144     -0.341742     -0.741783     -0.670604     -0.005650
  49.817383     41.163625     -0.624405     -0.994507      0.667236     -0.817627      0.241455      0.837891
   0.240479     -0.037537      5.500443     19.987625     -0.984131      0.0           0.086136      0.009628
   0.994370      0.094727     -0.084354      0.102737     -0.982681
     DN, DK, D, RK =        0.245358      -0.069999      0.020701      0.081135

 ICYCLE =  1  X, Y, Z =      49.434189      41.053940      -0.604111

 ICYCLE =  2  X, Y, Z =      49.539200      40.670013      -0.650436

 ICYCLE =  3  X, Y, Z =      49.314972      41.426086      -0.552948
```

```
DV =       0.091178  DDTT =       0.921616
VS(1) TO VS(9)       0.951624    0.398757    0.775542   47.300964   41.054474   -0.342635   -0.742004   -0.670362   -0.005551

    54          1.053933     0.122304     0.860446     0.0          0.951624
 0.398757     0.775542    47.300964    41.054474    -0.342635    -0.742004    -0.670362    -0.005551
49.434139    41.053940    -0.604111    -0.993942     0.665039    -0.804932     0.249512     0.827240
 0.247803    -0.033738     5.615167    20.293137    -0.982910     0.0          0.091461     0.010742
 0.993759     0.099354    -0.085752     0.108307    -0.980881
   DN, DK, D, RK =        0.239361    -0.072140     0.027075     0.108721

ICYCLE =  1  X, Y, Z =     49.055313    40.934372    -0.583466

ICYCLE =  2  X, Y, Z =     49.164627    40.555481    -0.632004

ICYCLE =  3  X, Y, Z =     48.927170    41.303268    -0.529297

DV =       0.080532  DDTT =       0.907984
VS(1) TO VS(9)       0.951596    0.399496    0.775059   47.168320   40.935028   -0.343551   -0.742228   -0.670118   -0.005450

    55          1.079991     0.122365     0.871064     0.0          0.951596
 0.399496     0.775059    47.168320    40.935028    -0.343551    -0.742228    -0.670118    -0.005450
49.055313    40.934372    -0.583466    -0.993515     0.665283    -0.793945     0.260010     0.813278
 0.258301    -0.041595     5.734750    20.590866    -0.982910     0.0          0.096741     0.011444
 0.993408     0.105957    -0.095123     0.114029    -0.981232
   DN, DK, D, RK =        0.234183    -0.075932     0.033264     0.135117

ICYCLE =  1  X, Y, Z =     48.680267    40.809006    -0.562622

ICYCLE =  2  X, Y, Z =     48.795303    40.434692    -0.613510

ICYCLE =  3  X, Y, Z =     48.537872    41.176453    -0.504410

DV =       0.070369  DDTT =       0.914972
VS(1) TO VS(9)       0.951570    0.400224    0.774581   47.029236   40.809753   -0.344494   -0.742456   -0.669868   -0.005348

    56          1.099990     0.125551     0.881201     0.0          0.951570
 0.400224     0.774581    47.029236    40.809753    -0.344494    -0.742456    -0.669868    -0.005348
48.680267    40.809006    -0.562622    -0.993271     0.666992    -0.785400     0.273438     0.797531
 0.271729    -0.046478     5.860081    20.880569    -0.985596     0.0          0.101608     0.011673
 0.993134     0.113525    -0.100357     0.119766    -0.983154
   DN, DK, D, RK =        0.234096    -0.083013     0.044685     0.179907

ICYCLE =  1  X, Y, Z =     48.307877    40.675705    -0.541733

ICYCLE =  2  X, Y, Z =     48.431015    40.304886    -0.595276

ICYCLE =  3  X, Y, Z =     48.146973    41.042450    -0.478119

DV =       0.060742  DDTT =       0.923350
VS(1) TO VS(9)       0.951546    0.400949    0.774104   46.881241   40.676514   -0.345480   -0.742591   -0.669611   -0.005243

    57          1.119988     0.128406     0.890804     0.0          0.951546
 0.400949     0.774104    46.881241    40.676514    -0.345480    -0.742591    -0.669611    -0.005243
48.307877    40.675705    -0.541733    -0.993134     0.671631    -0.778564     0.290771     0.778809
 0.289307    -0.052673     5.993372    21.161896    -0.980723     0.0          0.106415     0.011703
 0.993011     0.123047    -0.105667     0.125534    -0.986084
   DN, DK, D, RK =        0.238190    -0.093792     0.059139     0.231021

ICYCLE =  1  X, Y, Z =     47.937607    40.532776    -0.521011

ICYCLE =  2  X, Y, Z =     48.070328    40.164734    -0.577484

ICYCLE =  3  X, Y, Z =     47.754532    40.898178    -0.450195
```

```
DV =        0.051705  DOTT =        0.932593
VS(1) TO VS(9)        0.951525    0.401674    0.773624   46.722488   40.533752   -0.346519   -0.742935   -0.669344   -0.005134

     58          1.139987     0.131467     0.899821     0.0          0.951526
  0.401574       0.773324    46.722488    40.533752    -0.346519    -0.742935    -0.669344    -0.005134
 47.937607      40.532776    -0.521011    -0.993027     0.677490    -0.774170     0.313721     0.757324
  0.310303      -0.040287     6.136228    21.434067    -0.997559     0.0          0.111526     0.011612
  0.992889       0.134277    -0.111298     0.131577    -0.991455
     DN, DK, D, RK =         0.245183    -0.107993     0.077723     0.290107

ICYCLE =  1  X, Y, Z =       47.569534    40.378540    -0.500534

ICYCLE =  2  X, Y, Z =       47.713745    40.012543    -0.560471

ICYCLE =  3  X, Y, Z =       47.362946    40.739655    -0.420959


DV =        0.043326  DOTT =        0.942523
VS(1) TO VS(9)        0.951508    0.402403    0.773139   46.550934   40.379578   -0.347620   -0.743188   -0.669066   -0.005020

     59          1.159986     0.134773     0.908182     0.0          0.951508
  0.402403       0.773139    46.550934    40.379578    -0.347620    -0.743188    -0.669066    -0.005020
 47.569534      40.379560    -0.500534    -0.992783     0.684326    -0.768799     0.338623     0.734131
  0.332764      -0.067261     6.290520    21.696518    -1.005615     0.0          0.117020     0.011841
  0.992661       0.145996    -0.117371     0.138184    -0.997314
     DN, DK, D, RK =         0.252856    -0.125002     0.097984     0.347379

ICYCLE =  1  X, Y, Z =       47.204971    40.211502    -0.480530

ICYCLE =  2  X, Y, Z =       47.360184    39.847687    -0.544342

ICYCLE =  3  X, Y, Z =       46.978851    40.563095    -0.391861


DV =        0.035721  DOTT =        0.953029
VS(1) TO VS(9)        0.951494    0.403134    0.772651   46.365112   40.212616   -0.348790   -0.743451   -0.668778   -0.004903

     60          1.179984     0.138352     0.915773     0.0          0.951494
  0.403134       0.772651    46.365112    40.212616    -0.348790    -0.743451    -0.668778    -0.004903
 47.204971      40.211502    -0.480530    -0.992142     0.688477    -0.759766     0.363525     0.711670
  0.356445      -0.070938     6.457548    21.946762    -1.011719     0.0          0.123535     0.012894
  0.991974       0.157759    -0.124054     0.145462    -1.000244
     DN, DK, D, RK =         0.255530    -0.139979     0.116421     0.399580

ICYCLE =  1  X, Y, Z =       46.846634    40.032776    -0.461151

ICYCLE =  2  X, Y, Z =       47.010986    39.671829    -0.529572

ICYCLE =  3  X, Y, Z =       46.607712    40.369766    -0.364594


DV =        0.023928  DOTT =        0.962538
VS(1) TO VS(9)        0.951484    0.403858    0.772166   46.166122   40.033966   -0.350019   -0.743720   -0.668484   -0.004783

     61          1.199983     0.142182     0.922555     0.0          0.951484
  0.403858       0.772166    46.166122    40.033966    -0.350019    -0.743720    -0.668484    -0.004783
 46.846634      40.032776    -0.461151    -0.990799     0.688477    -0.743408     0.386475     0.691162
  0.377197      -0.069122     6.636306    22.183563    -1.012939     0.0          0.131393     0.015091
  0.990677       0.167236    -0.131714     0.153900    -1.000000
     DN, DK, D, RK =         0.249926    -0.148998     0.130312     0.447854

ICYCLE =  1  X, Y, Z =       46.497849    39.844254    -0.442551

ICYCLE =  2  X, Y, Z =       46.668686    39.487961    -0.516144

ICYCLE =  3  X, Y, Z =       46.252579    40.163437    -0.340576
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```
DV =        0.022976  DDTT =        0.970934
VS(1) TO VS(9)      0.951479     0.404565     0.771689    45.956207    39.845595    -0.351290    -0.743987    -0.668190    -0.004664

    62          1.219931     0.145220     0.928502     0.0          0.951479
 0.404565       0.771689    45.956207    39.845596    -0.351290    -0.743987    -0.668190    -0.004664
46.497849      39.844254    -0.442551    -0.989014     0.683105    -0.718750     0.402832     0.675781
 0.393311      -0.051584     6.824752    22.405151    -1.007813     0.0          0.140132     0.018433
 0.988592       0.173328    -0.139816     0.162842    -0.994629
   DN, DK, D, RK =          0.235863    -0.150360     0.138561     0.495370

ICYCLE =  1  X, Y, Z =       46.160675    39.648590    -0.425232

ICYCLE =  2  X, Y, Z =       46.336411    39.298309    -0.504135

ICYCLE =  3  X, Y, Z =       45.913727    39.949371    -0.320572

DV =        0.017854  DDTT =        0.977778
VS(1) TO VS(9)      0.951478     0.405252     0.771225    45.737991    39.649963    -0.352586    -0.744249    -0.667903    -0.004547

    63          1.239930     0.150414     0.933615     0.0          0.951478
 0.405252       0.771225    45.737991    39.649963    -0.352586    -0.744249    -0.667903    -0.004547
45.160675      39.648590    -0.425232    -0.986725     0.673340    -0.688721     0.415527     0.662598
 0.405006      -0.049026     7.020489    22.610565    -0.998535     0.0          0.149918     0.022919
 0.986526       0.177734    -0.148376     0.172379    -0.985107
   DN, DK, D, RK =          0.217136    -0.146411     0.141004     0.538416

ICYCLE =  1  X, Y, Z =       45.835480    39.447357    -0.409637

ICYCLE =  2  X, Y, Z =       46.015747    39.103577    -0.493713

ICYCLE =  3  X, Y, Z =       45.587479    39.731537    -0.303436

DV =        0.013538  DDTT =        0.983401
VS(1) TO VS(9)      0.951483     0.405926     0.770772    45.513596    39.448792    -0.353897    -0.744498    -0.667629    -0.004436

    64          1.259978     0.154726     0.937945     0.0          0.951483
 0.405926       0.770772    45.513596    39.448792    -0.353897    -0.744498    -0.667629    -0.004436
45.835480      39.447357    -0.409637    -0.984268     0.662598    -0.657471     0.426514     0.652588
 0.416748      -0.035019     7.221739    22.800354    -0.988281     0.0          0.159470     0.027481
 0.984100       0.180664    -0.156738     0.181656    -0.974609
   DN, DK, D, RK =          0.199703    -0.141877     0.141553     0.577839

ICYCLE =  1  X, Y, Z =       45.519913    39.239716    -0.396881

ICYCLE =  2  X, Y, Z =       45.703878    38.899124    -0.486191

ICYCLE =  3  X, Y, Z =       45.270462    39.509918    -0.288422

DV =        0.009980  DDTT =        0.988261
VS(1) TO VS(9)      0.951490     0.406620     0.770307    45.281830    39.241180    -0.355232    -0.744732    -0.667372    -0.004332

   NEXT STREAMLINE POINT EXCEEDS STAGNATION LIMIT

    65          1.279977     0.159176     0.941510     0.0          0.951490
 0.406620       0.770307    45.281830    39.241180    -0.355232    -0.744732    -0.667372    -0.004332
45.519913      39.239716    -0.396881    -0.982300     0.658691    -0.637207     0.444580     0.637451
 0.432617      -0.026703     7.429422    22.974991    -0.985596     0.0          0.167953     0.031479
 0.982132       0.187256    -0.164017     0.189667    -0.970215
   DN, DK, D, RK =          0.190210    -0.143490     0.141072     0.592084


   LPOINT =   517  NSPT =  65  ICOND =   0  VT =       0.770307
```

END OF STREAMLINE ROUTINE.

LOFF	RAY	517	0	0	0	0
IFC	ARRAY	65	0	0	0	0
LOCD	ARRAY	0	0	0	0	0
IFD	ARRAY	0	0	0	0	0
LOSF	ARRAY	0	0	0	0	0

EIGHT STRIPS NACA SWEPT WING SET 1 STREAMLINE NO. 1

FLAG1 = 1 FLAG2 = 2 FLAG3 = 0 FLAG4 = 0 FLAG5 = 0 NXT = 66 NTR = 10

H1 = 0.01000 K = 1.14000 EPS1 = 0.100000E-02

VREF =223.3000 SWANG = 0.0 REREF= 0.670000E+07

NX	X	S	UE	P1	P3	P5
1	0.0	0.0	0.17201E+03	0.0	0.10000E+01	0.0
2	0.14075E+00	0.14075E+00	0.17213E+03	0.20244E-01	0.10000E+01	-0.16033E+00
3	0.17224E+00	0.17224E+00	0.17308E+03	0.27330E-01	0.11943E+01	-0.18619E+00
4	0.20414E+00	0.20414E+00	0.17387E+03	0.37393E-01	0.13189E+01	-0.20864E+00
5	0.23655E+00	0.23666E+00	0.17514E+03	0.54155E-01	0.14058E+01	-0.24469E+00
6	0.26973E+00	0.26973E+00	0.17650E+03	0.75703E-01	0.14496E+01	-0.28978E+00
7	0.30314E+00	0.30314E+00	0.17844E+03	0.10444E+00	0.14535E+01	-0.32109E+00
8	0.33660E+00	0.33660E+00	0.18061E+03	0.13439E+00	0.14031E+01	-0.35329E+00
9	0.36990E+00	0.36990E+00	0.18325E+03	0.16047E+00	0.12877E+01	-0.33729E+00
10	0.40302E+00	0.40302E+00	0.18589E+03	0.16972E+00	0.11173E+01	-0.32030E+00
11	0.43603E+00	0.43603E+00	0.18843E+03	0.17104E+00	0.94133E+00	-0.29722E+00
12	0.46903E+00	0.46903E+00	0.19077E+03	0.17096E+00	0.76048E+00	-0.25345E+00
13	0.50218E+00	0.50218E+00	0.19303E+03	0.15905E+00	0.65517E+00	-0.23593E+00
14	0.53555E+00	0.53555E+00	0.19483E+03	0.14796E+00	0.52143E+00	-0.21341E+00
15	0.56924E+00	0.56924E+00	0.19664E+03	0.15192E+00	0.47851E+00	-0.18017E+00
16	0.60330E+00	0.60330E+00	0.19839E+03	0.13882E+00	0.43201E+00	-0.16734E+00
17	0.63770E+00	0.63770E+00	0.19976E+03	0.12960E+00	0.35964E+00	-0.16873E+00
18	0.67248E+00	0.67248E+00	0.20120E+03	0.15747E+00	0.38036E+00	-0.17204E+00
19	0.70762E+00	0.70762E+00	0.20306E+03	0.18468E+00	0.38549E+00	-0.13357E+00
20	0.74313E+00	0.74313E+00	0.20494E+03	0.20650E+00	0.45480E+00	-0.14202E+00
21	0.77895E+00	0.77895E+00	0.20712E+03	0.21206E+00	0.55411E+00	-0.13976E+00
22	0.81505E+00	0.81505E+00	0.20900E+03	0.19661E+00	0.65536E+00	-0.17931E+00
23	0.85136E+00	0.85136E+00	0.21077E+03	0.20307E+00	0.72427E+00	-0.17424E+00
24	0.88789E+00	0.88789E+00	0.21266E+03	0.19590E+00	0.75511E+00	-0.25171E+00
25	0.92457E+00	0.92457E+00	0.21420E+03	0.19449E+00	0.65044E+00	-0.19873E+00
26	0.96146E+00	0.96146E+00	0.21597E+03	0.19155E+00	0.56509E+00	-0.99617E-01

28	0.10353E+01	0.10358E+01	0.21915E+03	0.19258E+00	0.62770E+00	-0.37029E-01
29	0.10733E+01	0.10733E+01	0.22043E+03	0.14924E+00	0.75538E+00	-0.17257E-01
30	0.11103E+01	0.11108E+01	0.22145E+03	0.13926E+00	0.82251E+00	-0.89896E-01
31	0.11484E+01	0.11484E+01	0.22252E+03	0.12044E+00	0.88530E+00	-0.15987E+00
32	0.11861E+01	0.11861E+01	0.22321E+03	0.11612E+00	0.76522E+00	-0.96072E-01
33	0.12240E+01	0.12240E+01	0.22417E+03	0.15088E+00	0.75737E+00	0.20283E-01
34	0.12619E+01	0.12619E+01	0.22530E+03	0.13677E+00	0.78736E+00	0.95910E-01
35	0.12999E+01	0.12999E+01	0.22602E+03	0.13662E+00	0.90738E+00	0.34212E-01
36	0.13380E+01	0.13380E+01	0.22711E+03	0.12980E+00	0.10122E+01	-0.65121E-01
37	0.13761E+01	0.13761E+01	0.22770E+03	0.80301E-01	0.11132E+01	-0.12622E+00
38	0.14143E+01	0.14143E+01	0.22812E+03	0.90059E-01	0.11213E+01	0.11283E-01
39	0.14525E+01	0.14525E+01	0.22881E+03	0.61603E-01	0.94158E+00	0.17283E+00
40	0.14907E+01	0.14907E+01	0.22886E+03	0.73626E-01	0.89979E+00	0.18026E+00
41	0.15290E+01	0.15290E+01	0.22968E+03	0.83414E-01	0.95739E+00	0.14114E+00
42	0.15673E+01	0.15673E+01	0.22982E+03	0.58958E-01	0.11444E+01	-0.25043E-02
43	0.16055E+01	0.16055E+01	0.23034E+03	0.42075E-01	0.12438E+01	0.13838E+00
44	0.16437E+01	0.16437E+01	0.23029E+03	-0.14759E-02	0.10192E+01	0.15241E+00
45	0.16818E+01	0.16818E+01	0.23032E+03	0.26555E-01	0.11186E+01	0.15682E+00
46	0.17199E+01	0.17199E+01	0.23056E+03	0.33917E-01	0.11239E+01	0.20672E+00
47	0.17579E+01	0.17579E+01	0.23067E+03	0.31258E-02	0.11739E+01	0.27680E+00
48	0.17959E+01	0.17959E+01	0.23060E+03	-0.59495E-02	0.13226E+01	0.13799E+00
49	0.18339E+01	0.18339E+01	0.23061E+03	0.62974E-01	0.11846E+01	0.10153E+00
50	0.18718E+01	0.18718E+01	0.23120E+03	0.43090E-02	0.17063E+01	0.15084E+00
51	0.19095E+01	0.19095E+01	0.23066E+03	-0.72784E-01	0.16536E+01	0.75039E-01
52	0.19472E+01	0.19472E+01	0.23053E+03	0.29004E-01	0.12972E+01	0.12787E+00
53	0.19849E+01	0.19849E+01	0.23091E+03	-0.10862E-01	0.18772E+01	0.57192E-01
54	0.20223E+01	0.20223E+01	0.23044E+03	-0.11528E+00	0.15137E+01	0.90112E-01
55	0.20597E+01	0.20597E+01	0.22993E+03	-0.12145E+00	0.15038E+01	-0.57923E-01
56	0.20969E+01	0.20969E+01	0.22943E+03	-0.20265E+00	0.19596E+01	-0.10756E+00
57	0.21339E+01	0.21339E+01	0.22829E+03	-0.29639E+00	0.18807E+01	-0.25675E+00
58	0.21708E+01	0.21708E+01	0.22709E+03	-0.30933E+00	0.17032E+01	-0.27063E+00
59	0.22073E+01	0.22073E+01	0.22591E+03	-0.44504E+00	0.15022E+01	-0.50315E+00
60	0.22437E+01	0.22437E+01	0.22378E+03	-0.40564E+00	0.14316E+01	-0.85370E+00

62	0.23161E+01	0.23160E+01	0.22101E+03	-0.67261E+00	0.22154E+01	-0.12629E+01
63	0.23514E+01	0.23514E+01	0.21840E+03	-0.75863E+00	0.24837E+01	-0.14839E+01
64	0.23862E+01	0.23862E+01	0.21606E+03	-0.10885E+01	0.32296E+01	-0.15126E+01
65	0.24198E+01	0.24198E+01	0.21173E+03	-0.15452E+01	0.34972E+00	-0.17408E+01
66	0.24540E+01	0.24540E+01	0.20688E+03	-0.16824E+01	-0.43835E+01	-0.19781E+01

EIGHT STRIPS NACA SWEPT WING SET 1 STREAMLINE NO. 1

NX	IT	X	ETAE	DELTA	DX	DZ	THX	THZ	CFX	CFZ
1	6	0.0	0.79163E+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2	0.14075E+00	0.79168E+01	0.13069E-02	0.15259E-03	0.13082E-02	0.62595E-04	-0.13470E-05	0.13908E-02	-0.35375E-04
3	2	0.17224E+00	0.79168E+01	0.14418E-02	0.17599E-03	0.14436E-02	0.67847E-04	-0.18624E-05	0.12851E-02	-0.42792E-04
4	2	0.20414E+00	0.79168E+01	0.15660E-02	0.18477E-03	0.15533E-02	0.71395E-04	-0.24552E-05	0.12259E-02	-0.50832E-04
5	2	0.23666E+00	0.79168E+01	0.16800E-02	0.19133E-03	0.16832E-02	0.74130E-04	-0.31676E-05	0.11862E-02	-0.60879E-04
6	2	0.26973E+00	0.79168E+01	0.17867E-02	0.19688E-03	0.17907E-02	0.76669E-04	-0.41026E-05	0.11571E-02	-0.73905E-04
7	2	0.30314E+00	0.79168E+01	0.18838E-02	0.20165E-03	0.18883E-02	0.78959E-04	-0.51579E-05	0.11334E-02	-0.85550E-04
8	2	0.33660E+00	0.79168E+01	0.19730E-02	0.20637E-03	0.19793E-02	0.81281E-04	-0.63470E-05	0.11102E-02	-0.96923E-04
9	2	0.36990E+00	0.79168E+01	0.20534E-02	0.21178E-03	0.20607E-02	0.83876E-04	-0.74226E-05	0.10799E-02	-0.10041E-03
10	4	0.40302E+00	0.17462E+02	0.45940E-02	0.18208E-03	0.47002E-02	0.11213E-03	-0.62869E-05	0.41338E-02	-0.10990E-03
11	2	0.43603E+00	0.17462E+02	0.48405E-02	0.24529E-03	0.48563E-02	0.16419E-03	-0.73363E-05	0.43167E-02	-0.71543E-04
12	2	0.46903E+00	0.17462E+02	0.49987E-02	0.31101E-03	0.50085E-02	0.21105E-03	-0.99719E-05	0.37693E-02	-0.73872E-04
13	2	0.50213E+00	0.17462E+02	0.51420E-02	0.36587E-03	0.51543E-02	0.25412E-03	-0.12891E-04	0.38761E-02	-0.76255E-04
14	1	0.53555E+00	0.17462E+02	0.52854E-02	0.42561E-03	0.53015E-02	0.29594E-03	-0.16311E-04	0.35981E-02	-0.77155E-04
15	1	0.56924E+00	0.17462E+02	0.54241E-02	0.47821E-03	0.54435E-02	0.33632E-03	-0.19661E-04	0.36006E-02	-0.78698E-04
16	1	0.60330E+00	0.17462E+02	0.55593E-02	0.53302E-03	0.55823E-02	0.37538E-03	-0.22946E-04	0.33838E-02	-0.76644E-04
17	1	0.63770E+00	0.17462E+02	0.56960E-02	0.58173E-03	0.57224E-02	0.41436E-03	-0.26719E-04	0.33741E-02	-0.80644E-04
18	1	0.67248E+00	0.17462E+02	0.58283E-02	0.63134E-03	0.58590E-02	0.45208E-03	-0.31088E-04	0.33169E-02	-0.83047E-04
		****** WARNING - ETAE IS BEING REESTIMATED ****								
19	1	0.70762E+00	0.22716E+02	0.77415E-02	0.67445E-03	0.77750E-02	0.43645E-03	-0.34853E-04	0.32621E-02	-0.82221E-04
20	1	0.74313E+00	0.22716E+02	0.78957E-02	0.71208E-03	0.79344E-02	0.51782E-03	-0.38069E-04	0.32785E-02	-0.81194E-04
21	1	0.77895E+00	0.22716E+02	0.80422E-02	0.74807E-03	0.80833E-02	0.54553E-03	-0.41478E-04	0.32388E-02	-0.83866E-04
22	1	0.81505E+00	0.22716E+02	0.81835E-02	0.77950E-03	0.82349E-02	0.57076E-03	-0.45924E-04	0.31950E-02	-0.89554E-04
23	1	0.85136E+00	0.22716E+02	0.83346E-02	0.80848E-03	0.83851E-02	0.59400E-03	-0.51172E-04	0.31957E-02	-0.96373E-04
24	1	0.88789E+00	0.22716E+02	0.84736E-02	0.83621E-03	0.85315E-02	0.61561E-03	-0.58528E-04	0.31494E-02	-0.11036E-03
25	1	0.92457E+00	0.22716E+02	0.86156E-02	0.86496E-03	0.86815E-02	0.63857E-03	-0.66961E-04	0.31417E-02	-0.11712E-03
26	1	0.96146E+00	0.22716E+02	0.87467E-02	0.89717E-03	0.88189E-02	0.66336E-03	-0.70138E-04	0.31072E-02	-0.10406E-03
27	1	0.99856E+00	0.22716E+02	0.88880E-02	0.92998E-03	0.89543E-02	0.68903E-03	-0.67382E-04	0.30810E-02	-0.83284E-04
28	1	0.10358E+01	0.22716E+02	0.90158E-02	0.96043E-03	0.90782E-02	0.71275E-03	-0.63054E-04	0.30600E-02	-0.71795E-04
29	1	0.10733E+01	0.22716E+02	0.91507E-02	0.99072E-03	0.92095E-02	0.73598E-03	-0.59439E-04	0.30253E-02	-0.63477E-04
		****** WARNING - ETAE IS BEING REESTIMATED ****								
30	1	0.11108E+01	0.29543E+02	0.12079E-01	0.10216E-02	0.12137E-01	0.75917E-03	-0.58552E-04	0.30049E-02	-0.66009E-04
31	1	0.11484E+01	0.29543E+02	0.12253E-01	0.10515E-02	0.12315E-01	0.78226E-03	-0.63856E-04	0.29769E-02	-0.81297E-04
32	1	0.11861E+01	0.29543E+02	0.12433E-01	0.10840E-02	0.12501E-01	0.80725E-03	-0.69294E-04	0.29623E-02	-0.81849E-04
33	1	0.12240E+01	0.29543E+02	0.12602E-01	0.11159E-02	0.12668E-01	0.83189E-03	-0.66688E-04	0.29360E-02	-0.62361E-04
34	1	0.12619E+01	0.29543E+02	0.12764E-01	0.11448E-02	0.12819E-01	0.85486E-03	-0.55798E-04	0.29230E-02	-0.35399E-04
35	1	0.12999E+01	0.29543E+02	0.12934E-01	0.11731E-02	0.12979E-01	0.87702E-03	-0.45493E-04	0.29058E-02	-0.25782E-04
36	1	0.13380E+01	0.29543E+02	0.13091E-01	0.11967E-02	0.13134E-01	0.89575E-03	-0.43657E-04	0.28925E-02	-0.36078E-04
37	1	0.13761E+01	0.29543E+02	0.13259E-01	0.12215E-02	0.13303E-01	0.91483E-03	-0.49684E-04	0.28760E-02	-0.53069E-04
38	1	0.14143E+01	0.29543E+02	0.13429E-01	0.12470E-02	0.13480E-01	0.93429E-03	-0.51029E-04	0.28610E-02	-0.43338E-04
39	1	0.14525E+01	0.29543E+02	0.13589E-01	0.12752E-02	0.13625E-01	0.95569E-03	-0.37091E-04	0.28428E-02	-0.63018E-05
40	1	0.14907E+01	0.29543E+02	0.13765E-01	0.13092E-02	0.13781E-01	0.98146E-03	-0.16053E-04	0.28264E-02	0.22620E-04
41	1	0.15290E+01	0.29543E+02	0.13916E-01	0.13388E-02	0.13914E-01	0.10043E-02	0.16964E-05	0.28095E-02	0.35717E-04
42	1	0.15673E+01	0.29543E+02	0.14084E-01	0.13657E-02	0.14075E-01	0.10258E-02	0.81503E-05	0.27966E-02	0.23774E-04
43	1	0.16055E+01	0.29543E+02	0.14239E-01	0.13910E-02	0.14224E-01	0.10443E-02	0.14660E-04	0.27809E-02	0.35084E-04
44	1	0.16437E+01	0.29543E+02	0.14409E-01	0.14219E-02	0.14379E-01	0.10674E-02	0.20775E-04	0.27648E-02	0.54894E-04
45	1	0.16819E+01	0.29543E+02	0.14574E-01	0.14547E-02	0.14529E-01	0.10920E-02	0.45040E-04	0.27480E-02	0.66135E-04
46	1	0.17199E+01	0.29543E+02	0.14730E-01	0.14823E-02	0.14657E-01	0.11132E-02	0.62700E-04	0.27381E-02	0.85405E-04
47	1	0.17579E+01	0.29543E+02	0.14889E-01	0.15105E-02	0.14801E-01	0.11347E-02	0.96614E-04	0.27248E-02	0.11214E-03
48	1	0.17959E+01	0.29543E+02	0.15051E-01	0.15379E-02	0.14945E-01	0.11553E-02	0.10451E-03	0.27131E-02	0.11318E-03
49	1	0.18339E+01	0.29543E+02	0.15209E-01	0.15612E-02	0.15097E-01	0.11736E-02	0.11086E-03	0.27086E-02	0.10329E-03
50	1	0.18719E+01	0.29543E+02	0.15346E-01	0.15762E-02	0.15227E-01	0.11855E-02	0.1[illegible]5E-03	0.27018E-02	0.10895E-03
51	1	0.19095E+01	0.29543E+02	0.15518E-01	0.15956E-02	0.15395E-01	0.11995E-02	0.12132E-03	0.26900E-02	0.10245E-03

54	1	0.23023E+01	0.29543E+02	0.15977E-01	0.16540E-02	0.15849E-01	0.12432E-02	0.12636E-03	0.26654E-02	0.95008E-04
55	1	0.23397E+01	0.29543E+02	0.16142E-01	0.16857E-02	0.16021E-01	0.12665E-02	0.11894E-03	0.26476E-02	0.73527E-04
56	1	0.23763E+01	0.29543E+02	0.16305E-01	0.17163E-02	0.16204E-01	0.12873E-02	0.11630E-03	0.26271E-02	0.42774E-04
57	1	0.24139E+01	0.29543E+02	0.16489E-01	0.17509E-02	0.16420E-01	0.13107E-02	0.69484E-04	0.26012E-02	-0.57862E-06
58	1	0.24508E+01	0.29543E+02	0.16675E-01	0.17935E-02	0.16647E-01	0.13399E-02	0.27668E-04	0.25753E-02	-0.41963E-04
59	1	0.24873E+01	0.29543E+02	0.16859E-01	0.18479E-02	0.16883E-01	0.13774E-02	-0.29597E-04	0.25418E-02	-0.10761E-03
60	1	0.25237E+01	0.29543E+02	0.17073E-01	0.19135E-02	0.17207E-01	0.14229E-02	-0.13151E-03	0.25125E-02	-0.22705E-03
61	1	0.25600E+01	0.29543E+02	0.17246E-01	0.19567E-02	0.17518E-01	0.14527E-02	-0.28162E-03	0.24938E-02	-0.37160E-03
62	1	0.25950E+01	0.29543E+02	0.17459E-01	0.20070E-02	0.17893E-01	0.14856E-02	-0.46221E-03	0.24674E-02	-0.50850E-03
63	1	0.26314E+01	0.29543E+02	0.17697E-01	0.20761E-02	0.18323E-01	0.15298E-02	-0.67162E-03	0.24371E-02	-0.65495E-03
64	1	0.26682E+01	0.29543E+02	0.17923E-01	0.21499E-02	0.18744E-01	0.15742E-02	-0.89596E-03	0.23956E-02	-0.78742E-03
65	1	0.27048E+01	0.29543E+02	0.18233E-01	0.23095E-02	0.19313E-01	0.15744E-02	-0.12031E-02	0.23165E-02	-0.95069E-03

****** WARNING - ETAE IS BEING REESTIMATED ****

66	1	0.24540E+01	0.38415E+02	0.24153E-01	0.26577E-02	0.25741E-01	0.19031E-02	-0.18241E-02	0.22232E-02	-0.12126E-02

SET NO. 1 STREAMLINE NO. 1 IS COMPLETED.

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

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CASE ID	---	NACA
NO. OF LIFTING SECTIONS	---	1
NO. OF KUTTA POINTS	---	0
NO. OF OFF - BODY POINTS	---	0
IGNORE ELEMENT OPTION (NONZERO - YES, ZERO - NO)	---	0
SPECIAL LAST WAKE CALCULATION (NONZERO - YES, ZERO - NO)	---	1
FULL EXECUTION (NONZERO - NO, ZERO - YES)	---	0
STEP.VORT. METHOD (NONZERO - YES, ZERO - NO)	---	1
INPUT BODY - FORMATION METHOD (0 MEANS INPUT X, Y, Z COORDINATES)	---	0
SYMMETRY OPTION (NONZERO - YES, ZERO - NO)	---	1

COMPONENTS OF THE UNIFORM ONSET FLOWS

(1) 0.989707, 0.0 , 0.143106

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OTHER INPUT INFORMATION WILL BE WRITTEN ELSEWHERE IN THE OUTPUT.

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NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

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BEGIN THE SUBROUTINE INPUT . TIME IS 0.023 SEC.

BEGIN THE FORMATION OF ELEMENTS. TIME IS 0.099 SEC.

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

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N	M	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	1	73.548233 46.667877 -0.036140	72.718735 46.668198 -0.104020	71.185577 44.498032 -0.110410	72.053513 44.497711 -0.039240	0.081502 -0.054681 -0.995172	72.370789 45.574738 -0.072470	3.5148E-05 3.2037E+00 1.8513E+00	LIFT
	2	72.718735 46.668198 -0.104020	71.872849 46.668518 -0.173250	70.300583 44.498367 -0.182980	71.185577 44.498032 -0.110410	0.081509 -0.054623 -0.995175	71.513565 45.575089 -0.142695	3.4060E-05 3.2490E+00 1.8877E+00	
	3	71.872849 46.668518 -0.173250	70.123810 46.668747 -0.322010	68.470444 44.498596 -0.338740	70.300583 44.498367 -0.182980	0.084630 -0.056831 -0.994791	70.185806 45.575333 -0.254295	2.4915E-05 4.0398E+00 3.9044E+00	
	4	70.123810 46.668747 -0.322010	68.297974 46.668991 -0.475930	66.560074 44.499871 -0.499690	68.470444 44.498596 -0.338740	0.083837 -0.056225 -0.994892	68.356659 45.575607 -0.409169	2.3186E-05 4.1761E+00 4.0753E+00	
	5	68.297974 46.668991 -0.475930	66.389297 46.669296 -0.618300	64.562836 44.499207 -0.648370	66.560074 44.498871 -0.499690	0.074213 -0.048593 -0.996058	66.445786 45.575882 -0.560674	7.0870E-05 4.3231E+00 4.2555E+00	
	6	66.389297 46.669296 -0.618300	64.391464 46.669632 -0.732170	62.472443 44.499603 -0.767150	64.562836 44.499207 -0.648370	0.056776 -0.034042 -0.997806	64.446930 45.576233 -0.691620	8.9645E-05 4.4801E+00 4.4463E+00	
	7	64.391464 46.669632 -0.732170	62.298340 46.669998 -0.796390	60.282272 44.500000 -0.834060	62.472443 44.499603 -0.767150	0.030596 -0.011011 -0.999471	62.353668 45.576599 -0.782579	6.9372E-05 4.6479E+00 4.6505E+00	
	8	62.298340 46.669998 -0.796390	60.103714 46.670258 -0.787900	57.986008 44.500305 -0.825000	60.282272 44.500000 -0.834060	-0.003904 0.020943 -0.999773	60.159760 45.576935 -0.810978	4.3658E-05 4.8275E+00 4.8743E+00	
	9	60.103714 46.670258 -0.787900	57.797485 46.670364 -0.711200	55.572815 44.500427 -0.744760	57.986008 44.500305 -0.825000	-0.033193 0.049464 -0.998224	57.856781 45.577118 -0.767348	4.6231E-06 5.0238E+00 5.1298E+00	
	10	57.797485 46.670364 -0.711200	55.375366 46.670212 -0.543870	53.038498 44.500290 -0.569750	55.572815 44.500427 -0.744760	-0.068656 0.085777 -0.993946	55.437408 45.577118 -0.642507	1.8835E-05 5.2323E+00 5.4100E+00	
	11	55.375366 46.670212 -0.543870	54.115967 46.669846 -0.398300	51.720642 44.499969 -0.417540	53.038498 44.500290 -0.569750	-0.113772 0.134293 -0.984389	53.553650 45.576843 -0.482450	3.1363E-05 4.2524E+00 2.8397E+00	
	12	54.115967 46.669846 -0.398300	53.476013 46.669403 -0.289150	51.051102 44.499589 -0.303	51.720642 44.499969 -0.417540	-0.165237 0.190964 -0.967589	52.581333 45.576492 -0.352118	2.0701E-05 3.7567E+00 1.4672E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

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N	M	X Y Z	X V Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	13	53.476013 46.669403 -0.289150	53.151306 46.668869 -0.208570	50.715271 44.499161 -0.219800	51.051102 44.499588 -0.303230	-0.232663 0.266078 -0.935453	52.091583 45.578140 -0.255223	8.1658E-06 3.5123E+00 7.6478E-01	LIFT
	14	53.151306 46.668869 -0.208570	52.955795 46.669510 -0.139140	50.506866 44.499680 -0.144670	50.715271 44.499161 -0.219800	-0.315534 0.358787 -0.878470	51.819290 45.572739 -0.177842	2.7247E-05 3.4209E+00 5.0046E-01	
	15	52.955795 46.669510 -0.139140	52.824539 46.670425 -0.000010	50.369522 44.500458 -0.000010	50.506866 44.499680 -0.144670	-0.559424 0.632953 -0.535179	51.654800 45.576706 -0.070720	3.8747E-05 3.3783E+00 5.4843E-01	
	16	52.824539 46.670425 -0.000010	52.955063 46.670334 0.140130	50.506271 44.500351 0.146280	50.369522 44.500458 -0.000010	-0.563258 0.637181 0.526061	51.654724 45.577316 0.071609	7.2718E-05 3.3783E+00 5.5173E-01	
	17	52.955063 46.670334 0.140130	53.150070 46.670273 0.212580	50.714294 44.500259 0.222970	50.506271 44.500351 0.146280	-0.322756 0.366581 0.872610	51.818466 45.573776 0.180534	1.2646E-04 3.4209E+00 5.0136E-01	
	18	53.150070 46.670273 0.212580	53.475174 46.670364 0.293240	51.050461 44.500336 0.306330	50.714294 44.500259 0.222970	-0.232183 0.265088 0.935853	52.090698 45.579239 0.258813	1.3106E-05 3.5124E+00 7.6647E-01	
	19	53.475174 46.670364 0.293240	54.115311 46.671609 0.403090	51.720154 44.500549 0.421140	51.050461 44.500336 0.306330	-0.165991 0.191283 0.967397	52.581192 45.577286 0.356008	2.9009E-05 3.7567E+00 1.4685E+00	
	20	54.115311 46.670609 0.403090	55.374832 46.670837 0.549870	53.038086 44.500793 0.574370	51.720154 44.500549 0.421140	-0.114589 0.134583 0.984255	53.553146 45.577484 0.487198	8.6069E-05 4.2524E+00 2.8407E+00	
	21	55.374832 46.670837 0.549870	57.797119 46.670837 0.718540	55.572525 44.501819 0.750800	53.038086 44.500793 0.574370	-0.069199 0.085725 0.993913	55.437012 45.577621 0.648502	1.1683E-05 5.2324E+00 5.4111E+00	
	22	57.797119 46.670837 0.718540	60.103561 46.670563 0.796880	57.985870 44.500549 0.832880	55.572525 44.500809 0.750800	-0.033922 0.049639 0.998191	57.856552 45.577484 0.774903	2.7478E-05 5.0240E+00 5.1309E+00	
	23	60.103561 46.670563 0.796880	62.298538 46.670013 0.807780	60.282440 44.500015 0.844340	57.985870 44.500549 0.832880	-0.004972 0.021450 0.999758	60.159790 45.577087 0.820607	1.3694E-05 4.8277E+00 4.8756E+00	
	24	62.298538 46.670013 0.807780	64.392136 46.669266 0.746680	62.473053 44.499268 0.780)	60.282440 44.500015 0.844340	0.029164 -0.010253 0.999522	62.354095 45.576431 0.794937	2.9318E-06 4.6481E+00 4.6521E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

N	M	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	XO YO ZO	D T A	TYPE OF ELEMENT
1	25	64.392136 46.669266 0.746690	66.390518 46.668503 0.636260	64.563950 44.498474 0.664880	62.473053 44.499268 0.780420	0.055130 -0.033241 0.997926	64.447830 45.575684 0.707177	1.6503E-06 4.4803E+00 4.4476E+00	LIFT
	26	66.390518 46.668503 0.636260	68.299744 46.667786 0.497690	66.561722 44.497757 0.519900	64.563950 44.498474 0.664880	0.072285 -0.047702 0.996243	66.447235 45.574905 0.579778	3.5502E-06 4.3232E+00 4.2564E+00	
	27	68.299744 46.667786 0.497690	70.125977 46.667267 0.346940	68.472458 44.497223 0.361950	66.561722 44.497757 0.519900	0.082183 -0.055688 0.995060	68.358566 45.574310 0.431690	5.4836E-05 4.1762E+00 4.0757E+00	
	28	70.125977 46.667267 0.346940	71.875290 46.666840 0.201140	70.302841 44.496911 0.208840	68.472458 44.497223 0.361950	0.083066 -0.056536 0.994939	70.188034 45.573822 0.279760	1.3471E-04 4.0388E+00 3.9044E+00	
	29	71.875290 46.666840 0.201140	72.721451 46.666321 0.134500	71.188126 44.496277 0.139060	70.302841 44.496811 0.208840	0.078403 -0.053293 0.995496	71.516068 45.573364 0.170908	1.4536E-05 3.2499E+00 1.8880E+00	
	30	72.721451 46.666321 0.134500	73.551239 46.665802 0.069150	72.056351 44.495743 0.070620	71.188126 44.496277 0.139060	0.078404 -0.053321 0.995495	72.373566 45.572830 0.103344	1.5102E-05 3.2087E+00 1.8516E+00	
	31	73.551239 46.665802 0.069150	74.390035 46.665802 0.069150	72.923553 44.495743 0.070620	72.056351 44.495743 0.070620	0.0 0.000677 1.000000	73.222214 45.572571 0.069890	3.4692E-08 3.1794E+00 1.8402E+00	WAKE
2	1	72.053513 44.497711 -0.039240	71.185577 44.498032 -0.110410	69.216278 41.697556 -0.122770	70.134262 41.697189 -0.047890	0.081374 -0.052762 -0.995286	70.638321 43.084534 -0.080126	9.5632E-05 3.9872E+00 2.5132E+00	LIFT
	2	71.185577 44.498032 -0.110410	70.300583 44.498367 -0.182980	68.280228 41.697937 -0.199130	69.216278 41.697556 -0.122770	0.081376 -0.052900 -0.995279	69.736328 43.084869 -0.153889	9.5621E-05 4.0360E+00 2.5627E+00	
	3	70.300583 44.498367 -0.182980	68.470444 44.498596 -0.338740	66.344467 41.698242 -0.363110	68.280228 41.697937 -0.199130	0.084463 -0.055331 -0.994889	68.339218 43.085190 -0.271085	1.8632E-04 4.8501E+00 5.3006E+00	
	4	68.470444 44.498596 -0.338740	66.560074 44.498871 -0.499690	64.323776 41.698593 -0.532450	66.344467 41.698242 -0.363110	0.083591 -0.054958 -0.994984	66.414474 43.085490 -0.433631	2.1869E-04 5.0072E+00 5.5325E+00	
	5	66.560074 44.498871 -0.499690	64.542836 44.499207 -0.668370	62.211411 41.699236 -0.688[illegible]	64.323776 41.698593 -0.532450	0.073925 -0.047541 -0.996130	64.403793 43.085846 -0.592495	2.2054E-04 5.1755E+00 5.7772E+00	

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

UNIFORM ONSET FLOW = (0.989707E+00, 0.0 , 0.143106E+00)

FINAL OUTPUT FOR THE FOLLOWING ANGLE OF ATTACK

(0.989707, 0.0 , 0.143106)

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

UNIFORM ONSET FLOW = (0.989707E+00, 0.0 , 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	DCX DCY DCZ	NX NY NZ	SIG VN AREA
1	1	72.370789 45.574738 -0.072470	0.927096 0.115684 0.069567	0.936872 0.877729 0.122271	0.989565 0.123479 0.074255	0.081502 -0.054681 -0.995172	0.037847 0.000003 1.851255
	2	71.513565 45.575089 -0.142695	0.969444 0.141180 0.071647	0.982287 0.964887 0.035113	0.986926 0.143726 0.072939	0.081509 -0.054623 -0.995175	0.054783 0.000005 1.837727
	3	70.185806 45.575333 -0.254295	0.989065 0.201360 0.072640	1.011964 1.024071 -0.024071	0.977372 0.198980 0.071782	0.084630 -0.056831 -0.994791	0.064063 -0.000001 3.904398
	4	68.356659 45.575607 -0.409169	1.007667 0.250446 0.070769	1.040731 1.083121 -0.083121	0.968229 0.240644 0.067999	0.083837 -0.056225 -0.994892	0.069147 -0.000009 4.075283
	5	66.445786 45.575882 -0.560674	1.015993 0.275670 0.062258	1.054566 1.112111 -0.112111	0.963423 0.261406 0.059037	0.074213 -0.048593 -0.996058	0.072791 -0.000008 4.255460
	6	64.446930 45.576233 -0.691620	1.019288 0.291549 0.048960	1.061253 1.126257 -0.126257	0.960458 0.274721 0.045286	0.056776 -0.034042 -0.997806	0.077079 -0.000008 4.446280
	7	62.353668 45.576599 -0.782579	1.016891 0.309468 0.027728	1.063209 1.130605 -0.130605	0.956354 0.291045 0.026078	0.030596 -0.011011 -0.999471	0.083271 -0.000008 4.650612
	8	60.159760 45.576935 -0.810978	1.002567 0.336100 0.003134	1.057408 1.118113 -0.118113	0.948136 0.317853 0.002964	-0.003904 0.020943 -0.999773	0.092574 -0.000009 4.874245
	9	57.856781 45.577118 -0.767348	0.980020 0.365453 -0.014469	1.046042 1.094204 -0.094204	0.936884 0.349367 -0.013832	-0.033193 0.049464 -0.998224	0.104566 -0.000009 5.129755
	10	55.437408 45.577118 -0.642507	0.934159 0.402743 -0.029753	1.017714 1.035740 -0.035740	0.917900 0.395733 -0.029236	-0.068656 0.085777 -0.993946	0.121867 -0.000017 5.410012
	11	53.553650 45.576843 -0.482450	0.880072 0.415318 -0.045038	0.974188 0.949043 0.050957	0.903390 0.426322 -0.046232	-0.113772 0.134293 -0.984389	0.138242 -0.000018 2.839741

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

UNIFORM ONSET FLOW = (0.989707E+00, 0.0 , 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	QCX QCY QCZ	NX NY NZ	SIG VN AREA
1	12	52.581833 45.576492 -0.352118	0.759466 0.449190 -0.041023	0.883314 0.780243 0.219757	0.859792 0.508529 -0.046443	-0.165237 0.190964 -0.967589	0.148516 -0.000019 1.467240
	13	52.091583 45.578140 -0.255223	0.600241 0.572915 0.013688	0.829834 0.688708 0.311292	0.723283 0.690355 0.016494	-0.232663 0.266078 -0.935453	0.154522 -0.000018 0.764778
	14	51.819290 45.572739 -0.177842	0.424893 0.746543 0.152311	0.872386 0.761058 0.238942	0.487046 0.855747 0.174591	-0.315534 0.358787 -0.878470	0.154482 -0.000019 0.500457
	15	51.654800 45.576706 -0.070720	0.198910 0.985132 0.957211	1.387913 1.926302 -0.926302	0.143316 0.709794 0.689677	-0.559424 0.632953 -0.535179	0.145250 -0.000013 0.548432
	16	51.654724 45.577316 0.071609	1.250483 -0.212211 1.595854	2.038502 4.155488 -3.155488	0.613432 -0.104101 0.782856	-0.563258 0.637181 0.526061	-0.037122 -0.000044 0.551732
	17	51.818466 45.573776 0.180534	1.517966 -0.514027 0.777402	1.731235 3.172797 -2.172797	0.852199 -0.288579 0.436440	-0.322756 0.366581 0.872610	-0.109570 0.000004 0.501361
	18	52.090698 45.579239 0.258813	1.426581 -0.402942 0.468071	1.554537 2.416586 -1.416586	0.917689 -0.259204 0.301100	-0.232183 0.265083 0.935853	-0.122187 0.000003 0.766466
	19	52.581192 45.577286 0.356008	1.333995 -0.275412 0.283361	1.391290 1.935686 -0.935686	0.958819 -0.197954 0.203668	-0.165991 0.191283 0.967397	-0.126188 0.000009 1.468531
	20	53.553146 45.577484 0.437198	1.235990 -0.146567 0.163950	1.255401 1.576031 -0.576031	0.984538 -0.116749 0.130596	-0.114589 0.134583 0.984255	-0.117765 0.000013 2.340748
	21	55.437012 45.577621 0.648502	1.143954 -0.113140 0.083417	1.153008 1.329426 -0.329426	0.992148 -0.098126 0.077551	-0.069199 0.085725 0.993913	-0.100742 0.000013 5.411088
	22	57.856552 45.577484 0.774903	1.095542 -0.119805 0.043203	1.102920 1.216431 -0.216431	0.993311 -0.108626 0.039171	-0.033922 0.049639 0.998191	-0.085459 0.000015 5.130910

NACA SWEPT WING, 8 STRIPS, A=8.22, 30 SOURCE, 1 WAKE, 1 PL.SYM. ONE

UNIFORM ONSET FLOW = (0.999707E+00, 0.0 , 0.143106E+00)

ON - BODY POINTS FINAL OUTPUT

N	M	XO YO ZO	VX VY VZ	VT VTSQ CP	DCX DCY DCZ	NX NY NZ	SIG VN AREA
1	23	60.169790 45.577087 0.820607	1.073943 -0.127297 0.008087	1.081491 1.169622 -0.169622	0.993021 -0.117705 0.007477	-0.004972 0.021450 0.999758	-0.077039 0.000015 4.875637
	24	62.354095 45.576431 0.794937	1.048848 -0.121220 -0.031832	1.056310 1.115789 -0.115789	0.992936 -0.114758 -0.030135	0.029164 -0.010253 0.999522	-0.074337 0.000015 4.652055
	25	64.447830 45.575684 0.707177	1.021267 -0.107099 -0.056973	1.028617 1.058052 -0.058052	0.992854 -0.104119 -0.058304	0.055130 -0.033241 0.997926	-0.073872 0.000014 4.447557
	26	66.447235 45.574005 0.579778	0.995038 -0.088956 -0.076500	1.002726 1.005459 -0.005459	0.993132 -0.088714 -0.076293	0.072285 -0.047702 0.996243	-0.074281 0.000015 4.256392
	27	68.358566 45.574310 0.431690	0.972942 -0.068941 -0.084207	0.979009 0.958459 0.041541	0.993802 -0.070419 -0.086013	0.082183 -0.055688 0.995060	-0.074737 0.000007 4.075724
	28	70.188034 45.573822 0.279760	0.955919 -0.052539 -0.082784	0.960934 0.923395 0.076605	0.994781 -0.054675 -0.086149	0.083066 -0.056536 0.994939	-0.072822 0.000010 3.904449
	29	71.516068 45.573364 0.170908	0.942978 -0.040130 -0.076402	0.946919 0.896656 0.103344	0.995838 -0.042379 -0.080685	0.078403 -0.053293 0.995496	-0.065132 0.000012 1.887977
	30	72.373566 45.572830 0.103344	0.933524 -0.027761 -0.075021	0.936945 0.877865 0.122135	0.996349 -0.029629 -0.080070	0.078404 -0.053321 0.995495	-0.049499 -0.000011 1.851551

THE FORCE COMPONENTS OF THIS STRIP ARE -0.225973E+01 0.266826E+01 0.694168E+01

THE MOMENT COMPONENTS OF THIS STRIP ARE 0.315769E+03 -0.347150E+03 0.242923E+03

2	1	70.638321 43.094534 -0.080126	0.924951 0.093520 0.079703	0.932351 0.869279 0.130721	0.992063 0.100305 0.075832	0.081374 -0.052762 -0.995294	0.059918 -0.000037 2.513206

6.0 ACKNOWLEDGMENT

The author is grateful to Mr. Douglas Smyth for his contributions to the modification work of the streamline calculation from the Mark IV supersonic-hypersonic arbitrary-body program. The author is also indebted to Mr. Kalle Kaups for his valuable advice and suggestions made on the modification work of the small crossflow boundary-layer program. Finally, the author would like to acknowledge the significant effort by Mrs. Sue Schimke who assisted in checking out and analyzing the programming results.

7.0 REFERENCES

1. Hess, J.L.: A Fully Automatic Combined Potential-Flow Boundary-Layer Procedure for Calculating Viscous Effects on the Lifts and Pressure Distributions of Arbitrary Three-Dimensional Configurations. Douglas Aircraft Company Report No. MDC J7491, June 1977.

2. Mack, D.P. and Schimke,S.M.: User's Manual for a Fully Automatic Combined Three-Dimensional Potential-Flow Boundary-Layer Program. Douglas Aircraft Company Report No. MDC J7644/01, 1 August 1977.

3. Gentry, A.E., Smyth, D.N. and Oliver, W.R.: The Mark IV Supersonic-Hypersonic Arbitrary-Body Program. Technical Report AFFDL-TR-73-159, Nov. 1973.

4. Cebeci, T.: Calculation of Three-Dimensional Boundary Layers. I. Swept Infinite Cylinders and Small Cross Flows. AIAA J., Vol. 12, No. 6, June 1974. (Also McDonnell Douglas Report No. MDC-J5694, Nov. 1972.)

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* User's Manual for a Fully Automatic Three-Dimensional Potential-Flow Calculation Method. Part 2. With Viscous Correction by Small Crossflow Boundary-Layer Analysis		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report October 1973 - March 1977 6. PERFORMING ORG. REPORT NUMBER MDC J7644-02
7. AUTHOR(s) Dun-Pok Mack		8. CONTRACT OR GRANT NUMBER(s) N00014-74-C-0059
9. PERFORMING ORGANIZATION NAME AND ADDRESS Douglas Aircraft Company 3855 Lakewood Blvd. Long Beach, California 90846		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Ship Research and Development Center Bethesda, Maryland 20084		12. REPORT DATE 1 August 1977 13. NUMBER OF PAGES 84
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Boundary-Layer	Lifting Bodies	Viscous Flow
Computer Program	Potential Flow	Vorticity
Input-Output	Pressure Distribution	Wing-Body
Kutta Condition	Three-Dimensional Flow	

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes a computer program which calculates three-dimensional viscous effects on the lift and pressure distributions of arbitrary three-dimensional bodies. The program is a combination of a panel method, which computes the potential flow about arbitrary three-dimensional lifting configurations, and a three-dimensional boundary-layer method, which calculates the viscous effects with small crossflow. These effects are applied to the three-dimensional shape, as in Part 1, in a "strip-theory" sense and the resultant

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20. Abstract (cont.)

viscous lift and pressure distributions are again produced. The method of simulating the boundary layer in the final potential-flow calculation is by the addition of the displacement thickness to the original shape.

The computer program is written in Fortran IV for the IBM 370 systems. 16 temporary external units are used for storage. The region size needed to execute the program is about 360K bytes, but this is a direct function of the number of elements defining the configuration.

Also presented in this report is a detailed description of the program logic, complete instructions for executing the program, and a sample case. The basic description of the method, its background and capabilities is contained in McDonnell Douglas Report MDC J7491, "A Fully Automatic Combined Potential-Flow Boundary-Layer Procedure for Calculating Viscous Effects on the Lifts and Pressure Distributions of Arbitrary Three-Dimensional Configurations" by John L. Hess.